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BROOKLYN BOTANIC GARDEN

RECORD

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EDITED BY

C. STUART GAGER

CONTENTS

PAGE

Delectus Seminum, Brooklyn, 1926 (List of Seeds Offered in Exchange) 1

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* The names are arranged alphabetically.

BROOKLYN
BOTANIC GARDEN

RECORD

VOL. XVI JANUARY, 1927 NO. 1

DELECTUS SEMINUM, BROOKLYN 1926

LIST OF SEEDS OFFERED IN EXCHANGE

These seeds, collected during 1926, are offered to botanic gardens and to other regular correspondents; also, in limited quantities, to members of the Brooklyn Botanic Garden.

To simplify and improve our work we offer this year seeds of herbaceous plants only.

PTERIDOPHYTA

Marattiaceae

Angiopteris
evecta

Osmundaceae

Osmunda
regalis
Todea
barbara

Polypodiaceae

Adiantum
cuneatum
cuneatum var. Croweanum
hispidulum
trapeziforme
Aglaomorpha
Meyeniana
Asplenium
nidus
platyneuron
Blechnum
occidentale
Davallia
pentaphylla
Diplazium
lanceum
zeylanicum
Doodia
blechnoides
Drynaria
quercifolia
Dryopteris
erythrosora
opaca
Sieboldii

Microlepia
majuscula
Nephrolepis
acuminata
cordifolia
rivularis
Oleandra
articulata
Pellaea
viridis
Polypodium
aureum
aureum var. areolatum
aureum var. cristatum
punctatum
subauriculatum
vulgare
Polystichum
acrostichoides
capense
Pteris
cretica var. Wimsettii
Tectaria
cicutaria

Schizaeaceae

Aneimia
phyllitidis

Selaginellaceae

Selaginella
Emmeliana
Emmeliana var. aurea
Wildenovii

DICOTYLEDONES

Acanthaceae 266

Acanthus
longifolius
mollis

Aizoaceae 84

Mesembryanthemum
cordifolium
pinnatifidum
pomeridianum
pyropeum
Mollugo
verticillata
Tetragonia
expansa

Amarantaceae 79

Alternanthera
paronychioides
Amarantus
blitoides
caudatus
caudatus (yellow)
crispus
graecizans
retroflexus
sylvestris
Celosia
argentea
cristata
cristata (dwarf)
cristata (yellow)
plumosa
plumosa (yellow)

Apocynaceae 247

Amsonia
Tabernaemontana
Rhazya
orientalis
Vinca
rosea

Araliaceae 227

Aralia
hispida
nudicaulis
racemosa

Asclepiadaceae 248

Asclepias
phytolaccoides
Ceropegia
Woodii (tubers)

Cynanchum
nigrum
Vincetoxicum

Balsaminaceae 168

Impatiens
Balsamina
Oliveri
pallida
Roylei
scabrida

Basellaceae 86

Basella
rubra
rubra var. alba

Borraginaceae 252

Anchusa
officinalis
Caccinia
Rauwolfii
strigosa
Echium
vulgare
Lindelophia
longiflora
Lithospermum
distichum
Myosotis
scorpioides
Nonnea
rosea
Onosma
echioides
Symphytum
officinale

Campanulaceae 276

Campanula
alliariaefolia
bononiensis
carpatica
carpatica var. alba
carpatica var. turbinata
glomerata
lactiflora
latifolia
latifolia var. alba
latifolia var. eriocarpa
Medium var. calycanthema
persicifolia
persicifolia (white)
punctata
rotundifolia
rotundifolia var. Hostii
subpyrenaica
Trachelium
versicolor
Jasione
montana
Phyteuma
Scheuchzeri
Platycodon
grandiflorum
Mariesii
Specularia
perfoliata
Trachelium
caeruleum

Campanulaceae
—Lobelioideae 276a

Lobelia
cardinalis
Erinus
inflata
syphilitica

Capparidaceae 107

Cleome
spinosa
spinosa (white form)
Polanisia
trachysperma

Caryophyllaceae 87

Arenaria
graminifolia
Saxifraga
Cerastium
Biebersteinii
Thomasii
Dianthus
alpinus

Armeria
barbatus
caesius
chinensis var. macrosepalus
deltoides
gallicus
glacialis var. neglectus
petraeus
plumarius
sylvestris
Gypsophila
elegans
cerastioides
fastigiata
libanotica
perfoliata
repens
repens var. monstrosa
Lychnis
alba
alpina
chalcedonica
Coronaria
dioica
Flos-cuculi
Flos-Jovis
Githago
Viscaria var. splendens
Sagina
procumbens
Saponaria
caespitosa
officinalis
Vaccaria
Silene
acaulis
alpestris
Armeria
ciliata
Friwaldskyana
japonica
latifolia
maritima
noctiflora
orientalis
pendula
Schafta
Zawadskii
Spergula
sativa
Tunica
Saxifraga

Chenopodiaceae 78

Axyris
amarantoides
Chenopodium
Bonus-Henricus
capitatum
Hablitzia
tamnoides
Kochia
arenaria
hyssopifolia
Polycnenum
majus

Cistaceae 193

Helianthemum
globulariaefolium

Compositae 280

Achillea
abrotanoides
alpina
aurea
Clavenae
filipendulina
Ptarmica
tomentosa
Ammobium
alatum
Antennaria
neodioica
Anthemis
austriaca
Arctotis
grandis
Arnica
Chamissonis
foliosa
longifolia

Artemisia
Purshiana
vulgaris
Aster
alpinus
alpinus var. speciosus
cordifolius
Bellium
bellidioides
Buphthalmum
speciosum
Calendula
aegyptiaca
Carduus
Kerneri
Centaurea
americana
calvescens
macrocephala
Scabiosa
Chrysanthemum
cinerariaefolium
indicum
Parthenium
Coreopsis
grandiflora
lanceolata
palmata
tinctoria
Cryptostemma
calendulaceum
Dimorphotheca
annua
Echinops
persicus
Emilia
flammea
Erigeron
compositus
Eriophyllum
caespitosum
speciosus
Erlangea
tomentosa
Eupatorium
cannabinum
purpureum
Purpusii
Gaillardia
aristata
Helianthus
annuus
mollis
Helichrysum
bracteatum
Heliopsis
helianthoides var. Pitcheriana
Inula
Helenium
squarrosa
Leontopodium
alpinum
Leptosyne
Stillmannii
Matricaria
inodora
Onopordon
Acanthium
Rudbeckia
hirta
Sanvitalia
procumbens
Senecio
adonidifolius
Biebersteinii
clivorum
macrophyllus
Petasitis
Silphium
perfoliatum
Silybum
Marianum
Solidago
canadensis
Cutleri (S. Virgaurea var. alpina)
missouriensis
Stokesia
laevis
laevis var. alba
Tanacetum
huronense
Xanthium
spinosum

Zinnia
Haageana
verticillata

Compositae
—*Cichorieae 280a*

Catananche
caerulea
Cichorium
Endivia
Intybus
Crepis
grandiflora
Hieracium
aurantiacum
Bocconei
longifolium
rigidum
speciosum
Sonchus
palustris
Tragopogon
porrifolius

Convolvulaceae 249

Ipomoea
purpurea

Cornaceae 229

Cornus
canadensis

Crassulaceae 115

Bryophyllum
crenatum
Cotyledon
platyphylla
Echeveria
Whitei
Sedum
acre
Aizoon
album
Fabaria
hybridum
maximum
spectabile
stenopetalum
stoloniferum var. cocci-
neum
Sempervivum
aureum
balsamiferum

Cruciferae 105

Alyssum
argenteum
maritimum
montanum
saxatile
saxatile var. compactum
Arabis
procurrens
Berteroa
incana
Bunias
orientalis
Camelina
sativa
Draba
aizoides
Kotschyi
rigida
rupestris
Iberis
saxatilis
sempervirens
Matthiola
bicornis
Raphanus
sativus

Cucurbitaceae 275

Cucumis
Melo
Cucurbita
maxima
Ecballium
Elaterium

Datiscaceae 207

Datisca
cannabina

Dipsacaceae 274

Cephalaria
- ambrosioides
- Graeca

Dipsacus
- laciniatus

Scabiosa
- amoena
- australis
- caucasica
- graminifolia
- Pterocephala

Euphorbiaceae 147

Euphorbia
- amygdaloides
- maculata
- marginata
- myrsinites

Mercurialis
- annua

Ricinus
- communis

Frankeniaceae 190

Frankenia
- pulverulenta

Gentianaceae 246

Gentiana
- Bigelovii
- Cruciata
- puberula
- scabra

Nymphoides
- peltatum

Geraniaceae 129

Erodium
- amanum

Geranium
- albiflorum
- Grevilleanum
- ibericum
- pratense
- pratense var. album
- sylvaticum

Globulariaceae 265

Globularia
- cordifolia

Guttiferae 187

Hypericum
- ellipticum
- perforatum
- repens
- Richeri
- virginicum

Hydrophyllaceae 251

Hydrolea
- spinosa

Hydrophyllum
- canadense

Phacelia
- campanularia

Illecebraceae 86a

Corrigiola
- littoralis

Herniaria
- glabra

Scleranthus
- annuus

Labiatae 254

Agastache
- nepetoides

Ballota
- pseudodictamnus

Dracocephalum
- Moldavica

Galeopsis
- pyrenaica

Hyssopus
- officinalis

Lamium
- album

Monarda
- Bradburiana
- mollis

Nepeta
- macrantha

Ocimum
- Basilicum

Origanum
vulgare
Perilla
nankinensis
Phlomis
alpina
tuberosa
Physostegia
virginiana
Prunella
vulgaris
Salvia
acetabulosa
azurea var. grandiflora
cadmica
hians
Horminum
pratensis var. Baumgartenii
splendens
virgata
Scutellaria
alpina
baicalensis
peregrina
Sideritis
scordioides
Stachys
grandiflora
lanata
officinalis
palustris
sylvatica
Thymus
Serpyllum

Leguminosae
—Caesalpinioideae 127b

Cassia
marilandica
nictitans

Leguminosae
—Mimosoideae 127a

Desmanthus
illinoensis
Mimosa
pudica

Leguminosae
—Papilionatae 128

Arachis
hypogaea
Astragalus
alopecuroides
Cicer
Baptisia
australis
tinctoria
Coronilla
varia
Galega
officinalis
orientalis
Glycine
Soja (brown seeds)
Soja (yellow seeds)
Lathyrus
"Mary Lovett"
Lespedeza
capitata
Lupinus
polyphyllus
polyphyllus var. albiflorus
Medicago
falcata
sativa
scutellata
Melilotus
alba
Ononis
arvensis
Oxytropis
campestris
Phaseolus
vulgaris

Linaceae 132

Linum
flavum
hologynum
maritimum
perenne
usitatissimum

Lythraceae 216

Cuphea
lanceolata
procumbens
Lythrum
Salicaria
Salicaria var. roseum
virgatum
virgatum "Rose Queen"

Malvaceae 175

Althaea
officinalis
rosea
Callirhoë
involucrata
Hibiscus
militaris
Moscheutos (white, red center)
Sabdariffa
Trionum
Kitaibelia
vitifolia
Malope
trifida
Malva
crispa
verticillata

Nyctaginaceae 80

Mirabilis
Jalapa
Jalapa (pink form)
Jalapa (yellow form)
Jalapa (white form)
Oxybaphus
nyctagineus

Onagraceae 224

Clarkia
elegans
pulchella
Epilobium
angustifolium
hirsutum
nummularifolium
nummularifolium var. nerteroides
Godetia
lepida
Oenothera
missouriensis
pumila

Oxalidaceae 130

Oxalis
stricta

Papaveraceae 104

Argemone
mexicana
Bocconia
cordata
microcarpa
Eschscholtzia
californica
Glaucium
flavum
Papaver
alpinum
atlanticum
lateritium
orientale
Rhoeas
somniferum

Papaveraceae
—Fumarioideae 104a

Corydalis
sempervirens
Dicentra
eximia

Plantaginaceae 269

Plantago
palmata

Plumbaginaceae 238

Acantholimon
glumaceum
lepturoides
Armeria
juncea
vulgaris
vulgaris var. Laucheana

Limonium
latifolium
vulgare

Polemoniaceae 250

Gilia
achilleaefolia
capitata
Phlox
Drummondii
Polemonium
reptans

Polygonaceae 77

Eriogonum
racemosum
umbellatum
Polygonum
sagittatum
scandens
Sieboldii
virginianum

Portulacaceae 85

Anacampseros
arachnoides
Telephiastrum
Calandrinia
grandiflora
Lewisia
rediviva
Portulaca
grandiflora
marginata
oleracea
Talinum
patens

Primulaceae 237

Anagallis
arvensis
arvensis var. caerulea
linifolia
Androsace
carnea var. brigantiaca
septentrionalis
spinulifera
Lysimachia
dubia
punctata
terrestris
Primula
flagellicaulis
floribunda
kewensis
veris var. suaveolens
Steironema
ciliatum
Trientalis
americana

Pyrolaceae 231

Chimaphila
umbellata
Pyrola
americana

Ranunculaceae 91

Actaea
alba
rubra
Anemone
Pulsatilla
Cimicifuga
americana
racemosa
Clematis
integrifolia
Coptis
trifolia
Delphinium
grandiflorum
grandiflorum var. album
Nigella
damascena
Ranunculus
Cymbalaria
nemorosus
Thalictrum
angustifolium
dioicum
minus
polygamum

Trollius
laxus

Resedaceae 108

Astrocarpus
sesamoides
Reseda
alba
lutea
Luteola
odorata
odorata "Goliath"
Phyteuma

Rosaceae 126

Agrimonia
odorata
pilosa
Alchemilla
alpina
splendens
vulgaris
Duchesnea
indica
Fragaria
vesca var. alba
virginiana
Geum
macrophyllum
pallidum
Gillenia
trifoliata
Potentilla
alchemilloides
argentea var. Calabra
chrysantha
grandiflora
Hopwoodiana
nepalensis
Nuttallii
rupestris
tridentata
verna
viscosa

Rubiaceae 270

Asperula
orientalis
tinctoria
Crucianella
stylosa
Diodia
Dasycephala
Galium
purpureum
Spermacoce
tenuior

Rutaceae 137

Dictamnus
albus
albus var. ruber
Ruta
graveolens

Saxifragaceae 117

Francoa
appendiculata
Saxifraga
Aizoon
Cotyledon
crustata
Hostii
Macnabiana

Scrophulariaceae 257

Antirrhinum
Asarina
majus
maurandioides
Calceolaria
scabiosaefolia
Chaenostoma
foetidum
Digitalis
ambigua
Erinus
alpinus
Linaria
canadensis

Mimulus
Langsdorfii
luteus
Pentstemon
acuminatus
arizonicus
barbatus
barbatus var. Torreyi
glaber
grandiflorus
laevigatus var. Digitalis
unilateralis
Scrophularia
marilandica
sambucifolia
Verbascum
Blattaria
Veronica
austriaca
gentianoides
spicata var. rosea
Teucrium
Teucrium var. prostrata

Solanaceae 256

Atropa
Belladonna
Belladonna (yellow fruit)
Capsicum
annuum var. longum
Datura
meteloides
Stramonium
Lycopersicum
cerasiforme
Nicandra
Physalodes
Nicotiana
alata grandiflora (affinis)
rustica
Sanderae
Tabacum
Petunia
hybrida
Physalis
Franchetii
Salpiglossis
sinuata
Solanum
Capsicastrum

Stylidiaceae 278

Stylidium
adnatum

Tiliaceae 174

Corchorus
olitorius

Umbelliferae 228

Carum
Carvi
Coriandrum
sativum
Eryngium
alpinum
coeruleum
giganteum
Oliverianum
planum
Heracleum
lanatum
Levisticum
officinale
Oenanthe
pimpinelloides
Osmorhiza
Claytoni
Pimpinella
Anisum
Gouani
Silaus
pratensis
Sium
Sisarum
Trachymene
caerulea

Urticaceae 65

Laportea
moroides

Valerianaceae 273

Valeriana
alliariaefolia
officinalis

Verbenaceae 253

Lippia
nodiflora

Violaceae 198

Viola
lutea
tricolor

Zygophyllaceae 135

Peganum
Harmala

MONOCOTYLEDONES

Amaryllidaceae 340

Alstroemeria
aurantiaca

Araceae 323

Aglaonema
commutatum
costatum
Calla
palustris

Bromeliaceae 332

Dyckia
brevifolia
Tillandsia
Balbisiana
fasciculata

Commelinaceae 333

Commelina
coelestis
Palisota
Barteri
Rhoeo
discolor

Cyperaceae 320

Carex
divulsa
Grayii
punctata
Cyperus
alternifolius
Kyllinga
triceps

Gramineae 319

Anthoxanthum
odoratum
Avena
brevis
fatua
nuda
sativa "Early Champion"
sativa var. orientalis
sterilis
strigosa
Coix
Lachryma-Jobi
Dactylis
glomerata
Festuca
elatior
Glyceria
fluitans
Holcus
Sorghum "Blackhull Kafir"
Sorghum "Sumac Sorgo"
Sorghum "Feterita"
Sorghum "White Milo"
Hordeum
distichum (bearded)
vulgare
Miscanthus
saccharifer
sinensis var. gracillimus
Oryza
sativa

Panicum
miliaceum
Phalaris
arundinacea var. picta
Phleum
pratense
Secale
cereale
Setaria
italica

Iridaceae 344

Iris
dichotoma
graminea
orientalis "Snow Queen"
tectorum
tectorum var. alba

Liliaceae 338

Allium
fistulosum
Porrum
Amianthium
muscaetoxicum
Asparagus
officinalis
Sprengeri
Asphodeline
lutea
Chlorophytum
Orchidastrum
Clintonia
borealis
Galtonia
candicans
Gasteria
acinacifolia
mollis
nigricans
Hemerocallis
Thunbergii
Maianthemum
canadense
Medeola
virginiana
Muscari
botryoides
comosum
Polygonatum
biflorum
Ruscus
aculeatus
Smilacina
racemosa
Smilax
herbacea
Streptopus
roseus
Trillium
undulatum
Tulipa
Batalinii
Clusiana
Eichleri
Kaufmanniana
polychroma
primulina

Orchidaceae 350

Cypripedium
acaule
Habenaria
Hookeri
lacera

Taccaceae 342

Schizocapsa
plantaginea
Tacca
cristata
integrifolia

Zingiberaceae 346

Brachychilus
Horsfieldi

Applications for seeds should be received not later than March 1, 1927.

Address all requests to

DR. ALFRED GUNDERSEN,
Brooklyn Botanic Garden,
1000 Washington Ave.,
Brooklyn, N. Y., U. S. A.

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Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 1000 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park Station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS

OF THE

BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, seed list, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I, *Dedication Papers:* comprising scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. Price $1.00, plus postage.

CONTRIBUTIONS. Established, April 1, 1911. Papers originally published in periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

38. Physiologic races of oat smuts. 10 pages, 3 plates. 1924.

39. Relative susceptibility of selections from a Fulghum-Swedish select cross to the smuts of oats. 17 pages, 4 plates. 1925.

40. Physiological specialization of Ustilago hordei. 21 pages, 1 figure. 1924.

41. Factors influencing the infection of wheat by Tilletia Tritici and Tilletia laevis. 24 pages, 4 plates. 1924.

42. Variation among the sporelings of a fertile sport of the Boston fern. 27 pages, 15 figures. 1924.

43. Inheritance studies in Pisum. V. The inheritance of scimitar pod. 14 pages, 10 figures. 1925.

44. Modes of infection of sorghums by loose kernel smut. 17 pages, 3 plates. 1925.

45. The inheritance of resistance of oat hybrids to loose smut. 19 pages. 1925.

46. Geographical distribution and the cold-resisting character of certain herbaceous perennial and woody plant groups. 10 pages. 1926.

47. The cause of the persistent development of basal shoots from blighted chestnut trees. 7 pages, 1 figure. 1926.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Established, December, 1914. Since 1925 issued each year in the January number of the RECORD.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published, in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $7.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly. Subscription, $6.00 a year.

SIXTEENTH ANNUAL REPORT

OF THE

BROOKLYN BOTANIC GARDEN

1926

"The study of wisdom may always increase in this life, because nothing is perfect in human discoveries. It is most wretched always to be using what has been attained and never reach further for one's self."

—*ROGER BACON.*

"If practical teaching is the foundation of scientific education, I am sure that original work is its soul and spirit."

—*SIR FRANCIS DARWIN.*

BROOKLYN BOTANIC GARDEN RECORD

Vol. XVI APRIL, 1927 No. 2

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AT LANCASTER, PA.

BY THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

BROOKLYN, N. Y.

Entered as second-class matter in the postoffice at Lancaster, Pa., under act of August 24, 1912.

BROOKLYN BOTANIC GARDEN

Scientific, Educational, and Administrative Officers

SCIENTIFIC AND EDUCATIONAL

The Staff *

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MONTAGUE FREE, *Horticulturist*
ARTHUR HARMOUNT GRAVES, Ph.D., *Curator of Public Instruction*
ALFRED GUNDERSEN, Docteur de l'Université (Paris), *Curator of Plants*
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ALVHILD LINNEA WIMAN, *Stenographer*

LOUIS BUHLE, *Photographer*

* The names are arranged alphabetically.

SIXTEENTH ANNUAL REPORT

OF THE

BROOKLYN BOTANIC GARDEN

1926

FOR THE ADVANCEMENT OF BOTANY
AND THE SERVICE OF THE CITY

BROOKLYN, N. Y.
APRIL, 1927

LANCASTER PRESS, INC.
LANCASTER, PA.

SUMMARY FOR 1926

1. Total attendance for the year, over 514,000.

2. Educational contact with over 400,000 children and adults.

3. Over 34,000 living plants placed in classrooms of city schools.

4. Over 550,000 packets of seeds distributed to children in Brooklyn and other boroughs for planting in school and home gardens.

5. Over 1800 packets of seeds of trees and shrubs sent in exchange to foreign botanic gardens.

6. Conservation of Native Wild Flowers promoted in various ways in cooperation with other organizations.

7. Botanical research continued in plant pathology, genetics, plant breeding, forest pathology, ecology, and plant geography.

8. Over 1800 pages of research have been published during the year in four journals that have a world-wide circulation.

9. Bureau of Information has been made use of by the public to our capacity to respond.

10. Current issues of 847 periodicals on plant life have been received in the library.

11. Of a total budget of over $148,000 the Botanic Garden provided over $66,000 or over 43 per cent.

12. Members enjoy special privileges. See pages iv and v for information concerning membership.

THE ADVANCEMENT OF SCIENCE IN GREATER NEW YORK

A world-famous biologist (Pasteur) once said of Scotland that she was one of the first among nations to understand that intellect leads the world, and that for centuries she had "united her destinies with those of the human mind."

A similar reputation among cities is enjoyed by the Athens of ancient Greece, but most modern cities are generally regarded as having united their destinies chiefly with those of commerce. As a necessary consequence of her geographical location, this has been true of New York from the beginning.

But to her great honor, and as a necessary consequence of the character of her people, be it said that she has also united her destinies with those of literature, of art, and of education.

The existence of her municipal colleges, her numerous and justly famous museums, zoological park, aquarium, and two botanic gardens, all supported in whole or in part by appropriations in the annual tax budget of the city, bears eloquent testimony to the fact that New York City has also united her destinies with those of science, the youngest child of civilization and human progress.

She also is coming to understand that, not commerce, not wealth, not bigness, but intellect leads the world, and that the general level of intelligence of her citizens and her own contribution to human progress in the higher realm of intelligence is the true measure of a city's greatness. Such is the high goal toward which the Greater New York of today is progressing.

ITEMS FOR WHICH ADDITIONAL ENDOWMENT IS NOW NEEDED

FOR ANNUAL EXPENDITURES (Income from Endowment):

Personal Service

1. Salary increases	$ 10,000	
2. Retiring allowances	10,000	
3. New Positions	20,000	
4. Special Research Projects	10,000	
		$ 50,000

Other than Personal Service

5. Library (Books and Binding)	$ 2,500	
6. Herbarium	1,000	
7. Publishing and Printing	3,000	
8. Laboratory apparatus and equipment	1,500	
9. Botanical exploration and field work	2,000	
		10,000
Total additional annual income needed		$ 60,000

FOR PUBLISHING IRIS MEMOIR (with colored plates) ... $ 20,000

FOR PERMANENT IMPROVEMENTS:

10. Nursery, Experimental plot, and Greenhouses	$500,000
11. Rose Garden	10,000
Total, Permanent Improvements	$510,000

For a Summary of the Botanic Garden's activities for the year 1926, see page i.

INFORMATION CONCERNING MEMBERSHIP

The Brooklyn Institute of Arts and Sciences is organized in three main departments: 1. The Department of Education. 2. The Museums. 3. The Botanic Garden.

Any of the following seven classes of membership may be taken out through the Botanic Garden:

1. Annual member.....	$ 10	5. Donor	$ 10,000
2. Sustaining member.....	25	6. Patron	25,000
3. Life member.....	500	7. Benefactor	100,000
4. Permanent member....	2,500		

Sustaining members are annual members with full privileges in Departments one to three. Membership in classes two to seven carries full privileges in Departments one to three.

In addition to opportunities afforded to members of the Botanic Garden for public service through cooperating in its development, and helping to further its aims to advance and diffuse a knowledge and love of plants, to help preserve our native wild flowers, and to afford additional and much needed educational advantages in Brooklyn and Greater New York, members may also enjoy the privileges indicated on the following page.

Further information concerning membership may be had by addressing The Director, Brooklyn Botanic Garden, Brooklyn, N. Y., or by personal conference by appointment. Telephone, 6173 Prospect.

Date .....

To The Secretary,
Brooklyn Botanic Garden,
1000 Washington Ave., Brooklyn, N. Y.

Dear Sir:

I desire to become

An Annual Member.....	$10	A Donor	$10,000
A Sustaining Member.....	25	A Patron	25,000
A Life Member.....	500	A Benefactor	100,000
A Permanent Member.....	25,000		

Please find enclosed my check payable to Brooklyn Botanic Garden, and present my name to the Board of the Trustees for election.

Yours truly,

Name .....

Address .....

PRIVILEGES OF MEMBERSHIP

1. Free admission to the buildings and grounds at all times.
2. Cards of admission for self and friends to all exhibitions and openings preceding the admission of the general public, and to receptions.
3. Services of docent (by appointment), for self and party, when visiting the Garden.
4. Admission of member and his or her immediate family to all lectures, classes, field trips, and other scientific meetings under Garden auspices, at the Garden or elsewhere.
5. Special lectures and classes for the children of members.
6. Copies of Garden publications, as follows:

   a. Record
   b. Guides
   c. Leaflets
   d. Contributions

7. Privileges of the Library and Herbarium.
8. Expert advice on the choice and care of plants, indoors and out, on planting the home grounds, the care of lawns, and the treatment of plants affected by insect and fungous pests.
9. Identification of botanical specimens.
10. Participation in the periodical distribution of duplicate plant material and seeds, in accordance with special announcements sent to members from time to time.

THE BOTANIC GARDEN AND THE CITY

THE BROOKLYN BOTANIC GARDEN, established in 1910, is a Department of the Brooklyn Institute of Arts and Sciences. It is supported in part by municipal appropriations, and in part by private funds, including income from endowment, membership dues, and special contributions. Its articulation with the City is through the Department of Parks.

The City owns the land devoted to Garden purposes, builds, lights, and heats the buildings, and keeps them in repair, and includes in its annual tax budget an appropriation for other items of maintenance. One third of the cost of the present buildings (about $300,000) was met from private funds.

Appointments to all positions are made by the director of the Garden, with the approval of the Botanic Garden Governing Committee, and all authorized expenditures for maintenance are made in the name of the private organization, from funds advanced by the Institute, which, in turn, is reimbursed from time to time by the City, within the limits, and according to the terms, of the annual appropriation.

All plants have been purchased with private funds since the Garden was established. In addition to this, it has been the practice of the Garden to purchase all books for the library, all specimens for the herbarium, all lantern slides, and numerous other items, and to pay certain salaries, with private funds.

The urgent needs of the Garden for private funds for all purposes are greatly in excess of the present income from endowment, membership dues, and special contributions. The director of the Garden will be glad to give full information as to possible uses of such funds to any who may be interested.*

* A written *Agreement,* dated August 17, 1914, between the City of New York and the Institute, touching the Botanic Garden, published in full in the *Brooklyn Botanic Garden Record,* for April, 1915, amends the agreement of September 9, 1912, which amends the original agreement of September 28, 1909, published in the *Record* for January, 1912.

FORMS OF BEQUEST TO THE BROOKLYN BOTANIC GARDEN

Form of Bequest for General Purposes

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of ..... Dollars, the income from which said sum to be used for the educational and scientific work of the Brooklyn Botanic Garden.

Form of Bequest for a Curatorship

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of ..... Dollars, as an endowment for a curatorship in the Brooklyn Botanic Garden, the income from which sum to be used each year towards the payment of the salary of a curator in said Botanic Garden, to be known as the (here may be inserted the name of the donor or other person) curatorship.

Form of Bequest for a Fellowship

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of ..... Dollars, the income from which sum to be used in the payment of a fellowship for advanced botanical investigation in the Brooklyn Botanic Garden, to be known as the ..... fellowship.

Form of Bequest for other particular purposes designated by the testator

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of ..... Dollars, to be used (or the income from which to be used) for the Brooklyn Botanic Garden *

.....

.....

* The following additional purposes are suggested for which endowment is needed.

1. Botanical research.
2. Publishing the results of botanical investigations.
3. Popular botanical publication.
4. The endowment of a lectureship, or a lecture course.
5. Botanical illustration for publications and lectures.
6. The purchase and collecting of plants.
7. The beautifying of the grounds.
8. The purchase of publications for the library.
9. Extending and enriching our work of public education.
10. The construction and maintenance of a Rose Garden.

FIG. 1. Ecological Garden. Outlet of Swamp, and Rooted Aquatics. (6114.)

SIXTEENTH ANNUAL REPORT

OF THE

BROOKLYN BOTANIC GARDEN

1926 [1]

REPORT OF THE DIRECTOR

To the Botanic Garden Governing Committee:

It is my pleasure to present herewith the sixteenth annual report of the Brooklyn Botanic Garden, covering the year 1926.

Addition to Endowment

In my preceding report I recorded the generous offer of Mr. John D. Rockefeller, Jr., to contribute the sum of $250,000 to the permanent funds of the Garden, provided the same amount was secured from other sources before the close of the year 1926.

The initiation of plans for meeting the conditions of Mr. Rockefeller's pledge was announced at the meeting of the Governing Committee on January 22. At the meeting of the Committee on March 19, Mr. A. M. White was appointed chairman of an Endowment Fund Committee, and announced that Mr. Ralph Jonas had consented to act as vice-chairman.

Under date of April 15, this Committee sent invitations to a number of other representative citizens to become members of a *Citizens Committee*. The response to this invitation was very gratifying, and indicated a genuine and widespread interest in the Botanic Garden. The full membership and organization of the Endowment Fund Committee and of the Citizens Committee are given on pages 90–94 of this report.

On April 27 the Endowment Fund Committee gave a luncheon at the Hamilton Club, with representatives of the Brooklyn newspapers and others as guests. At this luncheon the history of the Botanic Garden was briefly reviewed as indicating the real need of

[1] Brooklyn Botanic Garden Record. Vol. XVI, No. 2. April, 1927.

such an institution in Brooklyn, and showing the extensive civic as well as educational and scientific work of the Garden. The need for additional funds was also set forth. Here, again, the sympathetic response of the representatives of the local press was most encouraging.

The Citizens Committee opened a special office at 16 Clinton Street, and the canvass for subscriptions was directed from this office with a special office force. So generous was the response that the quarter of a million dollars required to be subscribed and paid on or before December 31, 1926, was over-subscribed by July 8, and Mr. Rockefeller was so notified.

The letters exchanged between the treasurer of the committee and Mr. Rockefeller's office are here given, and in order to make the account complete, the letter containing Mr. Rockefeller's original pledge is repeated from my preceding annual report.

May 25, 1925.

Dear Mr. Gager:

Mr. John D. Rockefeller, Jr., for whom I am writing, has asked me to pledge on his behalf toward the endowment funds of the Brooklyn Botanic Garden the sum of $250,000 on condition that an equal sum is obtained in cash from other sources before Dec. 31, 1926, both sums to be applied toward endowment, unrestricted as to use.

While Mr. Rockefeller asks that the money which he thus contributes be added to the endowment funds, he realizes the unwisdom of seeking to forecast the requirements of the distant future, and is fully conscious of the danger attendant upon the establishment of any endowment fund in perpetuity. It will, therefore, be entirely agreeable to him to have the whole or any portion of the principal of this gift used, at any time after the expiration of twenty-five years from date, for any of the corporate purposes of the Brooklyn Botanic Garden, provided that such use is duly authorized by a four-fifths vote of its trustees.

Yours truly,

(Signed) Raymond B. Fosdick

Mr. C. Stuart Gager,
Brooklyn Botanic Garden,
Brooklyn, New York.

July 8, 1926.

My dear Mr. Rockefeller:

I have before me a copy of a letter written by Mr. Raymond B. Fosdick under date of May 25, 1925, addressed to Mr. C. Stuart Gager, in which Mr. Fosdick states that you are prepared to contribute to the Endowment Fund of the Brooklyn Botanic Garden the sum of $250,000 on condition that an equal sum is raised from other sources prior to December 31, 1926.

As you are perhaps aware, a group of Brooklyn Citizens have been engaged in raising the sum of $250,000 to meet your pledge. The writer is the Treasurer of this informal Committee.

This letter is written to certify to you that this Committee has now raised and the writer now has in his possession and on deposit in the Nassau National Bank of Brooklyn the sum of $250,739.

I trust this certification may prove sufficient and that we may receive your check at your convenience.

Very truly yours,

(Signed) G. Foster Smith,
Treasurer,
Brooklyn Botanic Garden Citizens Committee.

Mr. John D. Rockefeller, Jr.,
26 Broadway,
New York.

July 12, 1926.

My dear Mr. Smith:

In accordance with Mr. Rockefeller, Jr.'s pledge of May 25, 1925, signed by Mr. Raymond B. Fosdick and in accordance with the assurances contained in your letter of July 8, 1926, that $250,739 has been actually obtained in cash from other sources to date for the Endowment Fund, I am, on behalf of Mr. Rockefeller, Jr., enclosing his check in the sum of $250,000 payable to the Brooklyn Botanic Garden. This completes the obligation under Mr. Rockefeller's pledge of May 25, 1925.

May I repeat our congratulations, already given to Mr. C. Stuart Gager in our conversation this morning concerning Mr.

Rockefeller's pledge, on the splendid achievement of the Citizens Committee.

Sincerely yours,
(Signed) THOMAS B. APPLEGET.

Mr. G. Foster Smith, Treasurer,
Brooklyn Botanic Garden Citizens Committee,
The Nassau National Bank of Brooklyn,
Brooklyn, New York.

July 13, 1926.

My dear Mr. Appleget:

I beg to acknowledge your letter of the 12th enclosing Mr. Rockefeller, Jr.'s check in the sum of $250,000 payable to the Brooklyn Botanic Garden.

I also appreciate the kind expressions contained in your letter and wish to again thank you on behalf of the Brooklyn Botanic Garden for the very generous contribution which Mr. Rockefeller has made to us.

Very truly yours,
(Signed) G. FOSTER SMITH,
Treasurer,
Brooklyn Botanic Garden Citizens Committee

Mr. Thomas B. Appleget,
26 Broadway,
New York.

The Director and Staff of the Botanic Garden wish to express here to Mr. Rockefeller, to all individuals and organizations that subscribed to this fund, and to the Citizens Endowment Fund Committee, sincere appreciation of their generous contributions and labors, and in particular of the confidence in our work, of which these contributions and efforts are such substantial evidence.

This response of our citizens, making it possible for the Botanic Garden to supplement more generously the annual appropriations in the Tax Budget of the City, is a forceful illustration of what the Hon. Elihu Root has recently referred to as " the true American way, the true way in every self-governing people, to accomplish results which are desired, and which are not already pro-

vided for by the government, a way which follows the line of not lying down upon government, but of supplementing government by independent, individual enterprise and the activity and thought and devotion and self sacrifice of citizenship."

Special mention should be made of the contributions from the Department of Botany of the Brooklyn Institute of Arts and Sciences, from the Biology Departments of the Girls Technical and the Erasmus Hall and other High Schools, the Public Elementary Schools, and in particular most generous contributions from the Garden Teachers Association of the Brooklyn Botanic Garden (graduates from our course for the preparation of teachers of children's gardening), from our own Boys and Girls Club, from *Agricola,* the "official publication" of that Club, and from former members of the Club, who organized for the express purpose of raising a substantial contribution to the fund. The contribution from the staff of *Agricola* was the first to be received, with that from the Boys and Girls Club a close second.

A list of the contributors may be found on pages 94–103 of this report. The new funds will be administered under two accounts, namely *John D. Rockefeller, Jr., Fund,* and *Citizens Endowment Fund.*

Significance of the New Endowment

The significance of this addition to our permanent funds is threefold.

In the first place, Mr. Rockefeller's personal pledge of support is the highest possible endorsement of the accomplishments, future plans, and conduct of the Botanic Garden. It is well known that neither Mr. Rockefeller himself, nor the Rockefeller foundations contribute to the work of any institution without the most thorough examination of its organization, its activities, its aims, and the conduct of its affairs, financially and otherwise. This examination must establish entire confidence and also reveal the existence of a real need. No institution could have had a more thorough examination of its affairs (including its financial status and methods) than was given the Botanic Garden by Mr. Rockefeller's examiners. The resulting endorsement of our work is, and will always remain, one of the strongest assets of the Garden.

We shall realize that the result could not have been otherwise if we recall that the organization and development of the Garden has been carried out with faithful adherence to plans that had met the unreserved approval of the founder of the Garden, the late Mr. Alfred T. White.

In the second place, the generous response of the citizens who contributed to the fund is an asset hardly second to that of Mr. Rockefeller's own endorsement. Their response not only means public approval of the Garden's work, but is also the most convincing evidence that the Garden fills a real need in the community, and has won public approbation and confidence.

A Crisis Passed

The third significance of the new fund has reference to the future, and to the type of institution which is now assured. In connection with the death of the president of one of our great public museums the corporation entered on its records a minute which contained the following words: "When he came to the Presidency, the Museum had passed through the period of early struggles and local significance, and the point had been reached when the question was to be determined whether the original impulse was to spend itself, satisfied with a local and provincial success, or whether, on the other hand, the institution was to be developed into one of the great museums and educational influences of the world."

The Brooklyn Botanic Garden was facing precisely this situation when our needs were first presented to Mr. Rockefeller by the director. Was the original impulse, given by Mr. Alfred T. White and the two so closely connected with him in the establishment of the Garden, to spend itself, satisfied with a local, provincial, and otherwise limited success; or was the local value of the Garden to be multiplied manyfold by its becoming one of the great botanic gardens of world-wide influence and service to botanical science and education? Mr. Rockefeller's pledge and the public response to our canvass have decided that question. *No ideal short of this has, from the beginning, made any appeal to the director and staff, nor did it to Mr. White and those who were associated with him in laying the foundations.*

The Future?

It is no exaggeration to say that the Garden could not have continued much longer in the situation which was relieved by securing the new funds. An institution, like an army, can mark time for only a limited period; it must then either advance or retreat.

The income from the new funds will save a retreat, but they will only make it possible to prepare to advance. Certain activities which depended upon the precarious support of contributions that had to be annually solicited, or which had been abandoned or curtailed, are now assured of permanent financial support, but there remain some of the most essential aspects of our work still dependent on annual contributions, and quite inadequately financed.

The Botanic Garden is still in its infancy and, like all infants, its appetite seems out of proportion to its size, because it *must* grow, and to grow it *must* be nourished.

Specific Needs

Research Projects

In several preceding annual reports, mention has been made of our project for research in the broad subject of disease resistance in plants. The initiation of this work was made possible by the pledge of Mr. Alfred T. White to contribute the sum of $50,000 to be expended for this purpose over a term of years. In his letter of gift, Mr. White expressed the hope, and even the expectation that, by the close of the period he had provided for, some one of the existing foundations would place the work on a permanent footing. This has not yet been done, but the continuation of the work until the close of 1928 has been provided for by the generosity of those who have been convinced (after thorough investigation) of the importance of this work to science and to the Botanic Garden, and who are interested to have permanently established here this work in which Mr. White was so deeply interested.

To secure adequate endowment for this and other research projects should be made one of our chief concerns (as it is one

of our most vital needs) during the next eighteen months. Not less than $250,000 is required to insure an adequate annual income for the work.

Other Needs

Our present endowment, and the fund whose need has just been indicated, will only make possible the continuation of our present activities with the present staff. New curatorships should be created and filled, and the expenses incidental thereto must be provided for. The salaries, of course, are properly chargeable to the Tax Budget appropriation, but this has not, for some years, been adequate to meet the salaries. The relation between the annual Tax Budget appropriations and the private funds budget, and matters related thereto, are noted on page 23.

Funds for such purposes as the library, the collections of living plants, the herbaria, publication, and other items are still inadequate to our needs; and the development of such special collections as, for example, the rose garden and other horticultural features is yet to be provided for. A fuller statement of our needs was given on pages 36–37 of my *Fourteenth Annual Report* (for 1924).

The Garden and the Public

Attendance

Over 514,000 persons visited the Garden during 1926, an increase of more than 10,000 over 1925. The attendance figures have had to be estimated, in part, on account of delays in getting the recording turnstiles in working order after their re-setting in connection with the erection of the new fence. We feel that the above figure is, in all probability, an understatement.

Bureau of Information

The answering of inquiries from the public involves practically every member of the staff, and each year sees an increase in the number and importance of the questions asked, especially from business organizations. A commercial laboratory dealing in physicians' supplies asks for information concerning Sphagnum moss, valuable in surgical dressings. A large firm of undertakers asks

FIG. 2. Tulips in the lawn May 20, 1926. The dark ones are the scarlet *Tulipa Gesneriana spathulata;* the light ones, the yellow *T. Gesneriana lutea.* (5801.)

for a critical reading of the manuscript of a booklet to be published on flowers and their use in connection with funerals. Another firm asks for information as to the necessary procedure with the State Bureau of Plant Industry in connection with the importation of living plants from California to New York. The New York office of a concern in Liberia asks for information as to obtaining and growing Soya Beans and Kudzu Beans, and sugar cane in that country. A bond house in New York asks for the botanical name of a plant they wish to import, known to them only by a local English name. Inquiries are constantly received concerning such matters as the care of lawns and house plants, plant diseases, the naming of plants, and the names and addresses of nurserymen, seedsmen, and reliable companies to care for ornamental and shade trees. The list might be prolonged almost indefinitely. The inquiries come not only from New York City, but also from other cities and states, and from other countries.

News Releases

Over 500 clippings of newspaper notices concerning the Garden have been received during the year. As the curator of public instruction points out in his report, these notices appeared in the papers of twenty cities, distributed in eleven different states and Canada. While these notices imply a certain amount of publicity for the Garden, their chief value, perhaps, is in rendering our educational work more effective by making it available to a vastly greater number of people than can visit the Botanic Garden.

Broadcasting

"New York's Biggest Flower Garden" was the subject of a talk broadcasted by the director on the evening of May 1, from the Municipal Station, WNYC.

Public Exhibits

The Botanic Garden does not maintain a museum, except its collections of living plants in the conservatories and plantations. The entire garden is, in reality, an out-of-doors museum of living specimens. From time to time, however, temporary exhibits are installed.

Exhibit at Washington, D. C.—The American Horticultural Society held its Grand Spring Exhibition in the Hall of Nations, Washington Hotel, on June 8 and 9. By invitation the Garden exhibited its framed colored view of the Rose Garden which it is hoped to have realized before long at the Botanic Garden.

At the *Exposition of Women's Work* at the Hotel Astor, October 4–9, that part of our educational work under the supervision of Miss Shaw, curator of elementary instruction, was featured in a special booth, and the Garden is greatly indebted to members of the Woman's Auxiliary for assisting as attendants in charge of the booth.

The exhibit of *Cut Flowers and Vegetables,* raised in our Children's Garden, was held again this year (as last) on October 22 at the Eagle Building and was largely attended by members of the Junior Eagle Club (Brooklyn Daily *Eagle*) and their friends.

The *Exhibit of Christmas Greens,* which began several years ago under the auspices of the Department of Elementary Instruction, was taken over in 1926 (December 12–19) by a special committee of the Woman's Auxiliary under the chairmanship of Mrs. William H. Cary. It was installed in the rotunda of the Laboratory Building, and was greatly enriched by new materials and by new features, such as table decorations, living Christmas trees, and other features.

It is hoped by this exhibit to direct attention to the excessive use of such greens as Mountain Laurel, Ground Pine, and Holly collected wild; to encourage the growing of these greens as crop plants, in nurseries and otherwise; and to suggest other plants which may be found satisfactory as substitutes or supplements to the native wild plants now used to excess. Special literature was distributed in connection with the exhibit.

Meetings of Outside Organizations

The Garden is becoming increasingly popular as a meeting place of local organizations—garden clubs, civic organizations, mothers clubs of the schools, women's clubs, *et cetera.* Usually these meetings include in their program a talk by some member of the Garden staff on the work of the Garden, and an inspection

of our buildings and grounds under guidance. The number of such organizations meeting at the Garden in 1926 was 46, averaging nearly one a week. Twenty-one of the meetings were in May. Many of these organizations, and their members, made substantial contributions to our endowment fund, or other Garden funds.

The Garden and the Schools

Supply of Study Material

The extent to which the city schools make use of the Garden facilities steadily increases. During 1926 study material (chiefly living plants and plant parts) was supplied to 2450 teachers distributed in 196 schools, as against the 1925 figures of 2279 teachers in 81 schools. Forty-three High Schools and 104 Public Schools were served in this way as against 23 High Schools and 42 Public Schools a year ago. Colleges, training schools, and parochial and other private schools were also supplied.

Over 14,700 living plants were placed in 556 classrooms, not for study but as objects of beauty. Last year the number of classrooms thus supplied was 112.

Seeds for Children

Over 550,000 penny packets of seeds were distributed to school children—an increase of more than 21,500 over 1925. These figures become much more significant when one recalls the limited opportunities for gardening in a city like Brooklyn of over 2,000,000 population.

Addition statistics of our cooperation with the city schools are given in the following table:

STATISTICS OF PUBLIC EDUCATIONAL ACTIVITIES, 1926

Conferences	
Number of teachers	374
Number of pupils involved	18,324
Loan Lectures (Lantern slides, etc.)	
Number of teachers	28
Number of pupils attending	10,116

Study Material Supplied

Number of schools and annexes	
High	
In Brooklyn (Total number in Borough 15)	15
Outside of Brooklyn	28
Junior High Schools (Total in Borough 15)	12
Colleges, Universities, Museums	6
Training schools for teachers	2
Elementary schools	
In Brooklyn (Total number 220)	104
In Manhattan	5
In Queens	6
Private and Parochial Schools	18
Number of teachers	2,450
Number of pupils instructed	91,300

Exhibits Provided

Number of exhibits	7
Viewed by (number of persons)	4,600

Living Plants placed in school-rooms

Number of school-rooms	556
Number of plants	14,712

Agar (sterilized) for class use

Petri dishes	1,669
Flasks	6

Seed Packets for Children

Schools	178
Teachers	5,575
Pupils	225,417
Packets	550,840
Meetings of outside organizations	46
Newspaper notices concerning the garden	515

Model Lessons in Nature Study

The curator of elementary instruction, Miss Shaw, calls attention in her report, appended hereto (p. 70), to a new method of cooperation with the public schools, by the giving of model lessons in nature study in the auditorium of a public school (P.S. 48, Brooklyn). Nine lessons were given from October to December, inclusive. The work will be continued in 1927. The lessons were given to five classes at a time, in the presence of their teachers, the plant material being supplied by the Botanic Garden.

FIG. 3. Japanese Glory Tree, or Harlequin Glorybower (*Clerodendron trichotomum*), Verbena Family. Specimen in Brooklyn Botanic Garden, photographed July 24, 1926. (5992.)

Wild Flower Conservation

Conservation Conference

On May 26 a joint meeting on Wild Flower Conservation was held at the Laboratory Building. The cooperating societies were the Torrey Botanical Club, Wild Flower Preservation Society, American Fern Society, New York Bird and Tree Club, and the Federated Garden Clubs of New York State.

Addresses were given by Mr. Raymond H. Torrey, of the New York *Evening Post;* Mr. J. Otis Swift, of the New York *World,* Dr. R. C. Benedict, of the Botanic Garden; and Mr. Henry Hicks, life member of the Garden and member of the Long Island Park Commission.

State Conservation Laws

As a result of the cooperation of the above mentioned societies, including the Botanic Garden, the Conservation Law of New York State has been further amended so as to make it unlawful wilfully to destroy Trailing Arbutus (*Epigaea repens*), Flowering Dogwood (*Cornus florida*), Mountain Laurel (*Kalmia latifolia*), or Pink Lady's Slipper (*Cypripedium acaule*) "growing on the lands of the people of the state, or in any street, highway, public place or park belonging to or under the control of any county, city, town or village." Any person doing this "shall be deemed guilty of a misdemeanor." This act passed both houses of the New York State Legislature, and received the signature of Governor Smith, April 13, 1926, the act taking effect immediately.

Distribution of Hart's Tongue Fern

In our preceding report mention was made of our propagation (under the supervision of Dr. Benedict, resident investigator) of the Hart's Tongue Fern (*Scolopendrium vulgare*) from spores obtained at Green Lake, near Syracuse, N. Y. Dr. Benedict reports as follows on the continuation of this work during 1926:

"The program for the conservation of native plants endangered by industrial and park expansion, etc., has required a considerable amount of attention in correspondence during the year. Spore cultures of Hart's Tongue Fern, started during 1925, were

brought along to potting size by early summer of 1926 and, according to plans earlier announced, distribution was made of these young plants for the purpose of naturalization. Plants were sent to sixteen different people distributed in eight different states, with a distinct understanding that the ferns were to be set out under conditions as nearly like their natural habitat as possible, and those to whom the plants were sent were asked to keep close watch of them, so as to report the success of this broad demonstration experiment. A considerable number of the plants, which were too small during the summer of 1926, still remain and will be offered for distribution again in 1927, under the same conditions as last year.

"In connection with the Hart's Tongue, an effort was made to secure a good series of photographs of the so-called East Green Lake, near Jamesville, New York, at which some of the best groups of native Hart's Tongue Ferns are located. Activity by the Solvay Process Company has already destroyed the habitats of several colonies of this fern, and the quarrying operations have disfigured what was formerly a very beautiful spot. I was fortunately able to secure from Mr. Earle Wilson, of Syracuse, and Mr. H. E. Ransier, of Manlius, New York, a series of pictures showing conditions before and since the industrial operations were begun. Copies of these photographs and lantern slides from some of them have been added to the Garden collections."

Botanical and Horticultural Congresses

International Congress on Flower and Fruit Sterility

The conference was held August 12–14, under the auspices and with the financial support of the Horticultural Society of New York. The first day's sessions were held at Columbia University (in the morning) and at the New York Botanical Garden (in the afternoon); the second at the Boyce Thompson Institute for Plant Research; and the third at the Brooklyn Botanic Garden. At the latter session eleven scientific papers were presented in the morning and fifteen in the afternoon. Over one hundred delegates were present from about 38 institutions and organizations, and representing about 12 foreign countries. The delegates were

the guests of the Brooklyn Botanic Garden on the third day, and of the New York Botanical Garden and the Boyce Thompson Institute on the other two days. At the close of the sessions for the reading of papers the delegates were conducted on a tour of inspection of the conservatories, buildings, and grounds.

International Congress of Plant Sciences

This was (in reality, though not officially) the Fourth International Botanical Congress, the third having been held in Brussels in 1910. The date of the Fourth Congress was delayed and the place changed on account of the World War. All of the sessions were held at Cornell University, Ithaca. The director and three curators (Dr. Graves, Dr. White, and Mr. Taylor) attended as delegates from our Garden.

The program included 229 papers, embodying the results of research, besides various popular lectures and addresses and round table discussions. Over 900 botanists were present from about 25 countries. Every delegate spoke English, and, with rare exceptions, all the papers were presented in English. The Brooklyn Garden was one of several institutional patrons of the Congress. Many of the delegates visited our Garden before returning to their native lands.

Research During 1926

The investigations carried on during the year were in continuation of projects on which reports of progress have previously been made—plant disease resistance, plant breeding and genetics, geographical distribution, the vegetation of Long Island, plant physiology (especially the effects of radium rays on germ cells), and the classification and nomenclature of plants. In connection with the latter subject the curator of plants, Dr. Gundersen, spent the last four months of the year in Great Britain and Europe, visiting botanical centers, and conferring with those actively engaged in systematic work. He was still in Europe at the close of the year.

The Station for Experimental Evolution (of the Carnegie Institution of Washington) at Cold Spring Harbor, Long Island, supplied the pedigreed plants (of Jimson Weed—*Datura*) which

were absolutely essential for reliable work on the possibility of modifying inheritance by experimental treatment of germ cells.

Iris Project

The Garden has had the helpful cooperation of the American Iris Society, and of various individual members of it, in continued work on the Iris Project. As previously stated, this project is confined to the beardless irises, and includes a comparative study of varieties, nomenclature, methods of cultivation, breeding, and iris diseases. A large number of accurate and very beautiful colored illustrations by Miss Maud H. Purdy are accumulating, and it is hoped that funds may become available during the coming year to make it possible to include reproductions of these in a monograph on this group of Iris. A fuller report of the work is given on pages 32–33, by Dr. George M. Reed, who has the project in charge.

Non-technical summaries of the year's investigations are given on pages 25–50, following.

Plantations and Grounds

The New Fence

Work on the erection of the new "wrought iron" fence surrounding the Botanic Garden property was completed during the year. The new fence not only serves the purpose for which it was intended, but also serves to emphasize the need for proper entrance structures at the various gates.

Gardening Operations

In addition to the regular maintenance operations, considerable replanting and regrouping has been necessary, particularly in the group of the apples and their relatives. The details of this work are more fully recorded in the appended report of the Horticulturist, Mr. Free.

Work on the plantations did not begin until April 5, over two weeks later than usual. The delay was occasioned chiefly by inadequate appropriations for labor. Fortunately the Spring was an unusually late one.

Undeveloped Area

The entire North Addition, between Mt. Prospect Reservoir and the Brooklyn Museum, still remains under the plow on account of insufficient labor to grade it and put it into lawn, preparatory to planting. It is now twelve years since this area was brought to its present rough grade. Its frontage on Eastern Parkway, the completion of new apartment houses along the entire block opposite the Garden, and the great increase in the use of the entrance at Eastern Parkway, make it very urgent that the area be top-graded and planted, and also that a suitable entrance be constructed at this point.

Rose Garden

Figure 4 (p. 20) is reproduced from a colored sketch of the proposed Rose Garden, planned by our consulting landscape architect, Mr. Harold A. Caparn. This, when realized, would be one of the most beautiful and instructive rose gardens in America. The site chosen for it is the area of approximately one acre, just west of the Esplanade. It is estimated that the total cost of grading, soil improvement, construction of arbors, planting, etc., would approximate $10,000. The director will be glad to show the colored sketch, and explain the details of the plan to anyone who may be interested. This garden would unquestionably be one of the most popular features of the Botanic Garden.

Herbarium

The accessions to the Phanerogamic Herbarium have been 678 specimens and to the Cryptogamic Herbarium 407—a total of 1085, as compared to 646, 205, and 851 respectively for 1925.

The Cryptogamic Herbarium has now grown to the full capacity of its present quarters. Further expansion, which is inevitable, will make it necessary to find a more commodious room.

Library

Library accessions totaled 7505 as compared with 7364 a year ago.

FIG. 4. Proposed Rose Garden. Photograph of the colored sketch prepared by the landscape architect, Mr. Harold A. Caparn. (5710.)

The number of periodical publications of which current issues were received during the year was 847, the largest number since the Botanic Garden was established.

Seed Exchange

The annual *Delectus Seminum* (List of Seeds Offered in Exchange) was published in the Botanic Garden RECORD for January, 1926. This year, for the first time, we restricted the list of seeds to woody plants. Seeds were offered of 184 species of trees and shrubs, and 1893 packets of seed were sent to 71 botanic gardens in foreign countries. In exchange we received 963 packets.

Membership

Members are availing themselves of special membership privileges more and more each year, including free enrollment in courses of instruction (for which tuition is charged to non-members), participation in our periodical distribution of surplus plant material, utilization of our Bureau of Information, and otherwise.

The total number of members of all classes (as of April 12, 1927) is 1220. The list of members may be found on pages 126–141. The Botanic Garden will extend membership courtesies during 1927 to those who contributed to the Citizens Endowment Fund.

Canvass for new members by telephone (the method employed for about three years) still continues to yield larger returns than any other plan.

Gifts

A list of those who have contributed plants, seeds, books, and miscellaneous items may be found on pages 32 and 103–109; contributors to the annual Collections Fund on page 000, and contributors to the Citizens Endowment Fund on pages 94–103. The amounts given by the various contributors to this fund are omitted, for small amounts often mean quite as much interest and generosity as do larger amounts.

All of these gifts have been officially acknowledged with cordial thanks; it is a pleasure to make public recognition of them here.

Twelfth Annual Spring Inspection

This event, held each year on the second Tuesday in May, has come to be recognized as one of the delightful social events of Brooklyn. In fact it is the only "garden party" of the year in this Borough. It is preeminently a function of the Woman's Auxiliary, now under the Chairmanship of Mrs. Glentworth R. Butler. The inspection was in immediate charge of a speciai committee, of which Mrs. James M. Hills is a most efficient chairman.

The attendance in 1926 was about 1200, an increase of nearly 50 per cent. over a year ago. There were more flowers and more kinds of flowers in bloom than ever before at a Spring Inspection.

It is a pleasure to express here lively appreciation of the large amount of work, and the contributions of various kinds, of the members of the Auxiliary and of their friends who assisted at the tea tables and otherwise.

Appointments and Resignations

The following new appointments and resignations have occurred during the year:

Miss Hilda Loines, as chairman of the Botanic Garden Governing Committee, in place of Mr. Frank Bailey, who resigned on February 19.

Mrs. Glentworth R. Butler, as chairman of the Woman's Auxiliary, in place of Miss Hilda Loines, resigned.

Miss Marjorie R. Swabey, A.B., research assistant, February 16, in place of Miss Laura Alma Kolk, M.A., who resigned December 31, 1925.

Miss Margaret R. Ellis, curatorial assistant, resigned August 31 on account of the anticipated absence for several months in Europe of the curator of plants. The position remained unfilled at the close of the year.

Miss Hester M. Rusk, A.B., curatorial assistant, September 1, in place of Miss Charlotte S. Young, A.B., who resigned as of April 1.

Miss Katharyn P. Clark, A.B., instructor, September 15, in place of Mrs. Maude Hickok Free, who resigned September 15.

Miss Jeannette M. MacColl, A.B., secretary to the director, September 15, in place of Miss Ann C. Ohlander, who resigned July 20.

Miss Margery H. Udell, curatorial assistant, October 1, in place of Mrs. Lois Davis Van Gorden, who resigned October 15.

Financial

Tax Budget Accounts

The original Tax Budget appropriation for the Garden was $84,616.00, as against $85,245.00 in 1925, a decrease of $629.00. The amount requested was $116,582.00, an increase of $29,993.00 over 1925.

The original appropriation proved quite inadequate to meet absolutely essential needs, and was increased by two supplementary appropriations, as follows:

July 17, $1,973.00, for Repairs and Replacements. This was derived by transfer of funds from "Miscellaneous, Kings County, Code 3510, Kings County Fund for Salary and Wage Accruals."

December 2, $900.00, for additional supplies, materials, and telephone service. This was derived by transfer of funds from "Code 3039, City Fund for Salary and Wage Accruals."

This made the total appropriation for the year $87,489.00, or $2,244.00 more than for 1925.

Private Funds Accounts

The total Private Funds Budget for 1926 was $66,178.60, an increase of $3,149.12 over 1925.

Of the total Botanic Garden Budget for 1926 ($148,359.91) 57 per cent. was provided by Tax Budget appropriation, and 43 per cent. from Private Funds. A year ago 42 per cent. of the totai budget was met from private funds.

The Endowment Increment Principal was increased during the year by $5,307.69, derived from accrued interest and from additions from the contributing funds. At the close of 1926 the principal amounted to $32,972.94.

Retiring Allowances

The need of making early provision for Retiring Allowances is urgent. Each year's delay (with the advancing ages of prospective beneficiaries) means a higher ultimate cost to the Botanic Garden. The experience of the Carnegie Foundation for the Advancement of Teaching and other insurance organizations has shown that the continuing success of a pension system can be secured only by the cooperation of the employee and employer.

It is hoped that, in the not distant future, funds may become available for initiating a plan involving contributions from those to participate in the benefits.

Need of Additional Propagating Houses

I wish to call special attention to the urgent need of additional greenhouses for propagating, for experimental work, and for raising and caring for the living plant material which we are called upon to supply to the city schools in increasing amount each year. Work now organized is greatly hampered, and the enrichment of our collections, our school service, and our investigations will remain quite impossible until additional propagating houses become available.

Accompanying Papers

Administrative reports of members of staff, reports on botanical research conducted at the Garden during 1926, the financial statement, Appendices 1–8 (including a list of the names of contributors to the Citizens Endowment Fund), and a list of the officers and members of the Botanic Garden are appended as a part of this report.

Respectfully submitted,

C. Stuart Gager,
Director.

REPORTS ON RESEARCH FOR 1926

Genetics and Plant Breeding

Influence of Radium Rays upon Hereditary Variations in the Jimson Weed, Datura Stramonium

By C. STUART GAGER
In cooperation with
A. F. BLAKESLEE,

Department of Genetics, Carnegie Institution of Washington

The Jimson Weed (*Datura Stramonium*) has shown itself especially adapted to experimentation regarding the laws of inheritance and evolution. Hereditary variation can be brought about either by mutative changes in the number of the hereditary bodies (chromosomes) or by mutations in the factors which these chromosomes contain. The discovery of any stimulus which will accelerate these processes of mutation, which are extremely rare, would be of much scientific interest and might have considerable economic importance.

In continuation of the senior author's earlier investigations on the effects of radium on plant tissues, he made a preliminary study of the effects of radium treatment upon the hereditary units in flowers of Jimson Weeds. From one of the three treated flowers there were obtained in the offspring: (a) 17.7 per cent. of chromosomal mutations, a much higher percentage than ever obtained from untreated capsules, the average for over 15,000 offspring being 0.47 per cent., (b) a new compound chromosomal type, called Nubbin (from the character of the fruit-pod), in which some of the chromosomes appear to have been broken in two and joined together again in new combinations, (c) two new factor mutations out of 18 of the offspring tested. It is believed that the increase of chromosomal mutations was due to the radium treatment and that the radium may also have been responsible for the production of the compound chromosomal type Nubbin and for the two new factor mutations. Further experiments, however, will be necessary to determine whether in

fact radium has the power to induce new factor mutations and to break up chromosomes into parts which may be rearranged to form such compound types as Nubbin. It is planned to continue the radium experiments in the near future.

For the radium preparations used in these experiments, the authors are indebted to the Memorial Hospital, New York City, and the personal cooperation of Dr. Halsey J. Bagg, of the Hospital Staff.

The Genetic Analysis of Garden and Field Peas (Pisum)

By Orland E. White, Dorothy I. Neff,
and Mary Ellen Peck

Investigations on inheritance and variation in field and garden peas have been continued in 1926, along the lines mentioned in previous reports. Our original experimental stocks consisted of several hundred varieties and wild species collected through the assistance of many institutions and people from all over the pea-growing world. In addition to the importance of such a collection for our own experimental work, we have been enabled to help others interested along similar lines by sending them seed of or information concerning the various types. Thus this collection has served to bring about interchange of ideas, and unofficial cooperation between workers along this line in Sweden, Holland, England, Germany, Austria, Finland, Japan, Egypt, and various institutions in the United States. And this in turn has helped to prevent unnecessary duplication.

Many of these varieties and species have peculiar and little known characters. Through crossing these different types, and studying the inheritance of the characters by which they differ and the relations of these characters to each other and to various environments, a better understanding of the laws underlying inheritance and variation and of the importance of inheritance and environment in the organism's make-up is obtained. Year by year new facts concerning the inheritance relations of pea characters are discovered, and these, when incorporated with those already known, serve not only to increase our understanding of how to make more desirable pea plants, but also more desirable plants and animals in general.

At the present time, through the combined work of all those interested in the hereditary make-up of peas, there is extant a considerable body of knowledge concerning the mode of inheritance of over 120 characters of peas. The effect which the presence of many of these characters in the same plant has on each other is also known, as for example when the hereditary determiner for yellow pod is present in the same plant with one that we call purple-pod, the plant has beautiful rich red pods, provided also the B determiner for flower color is present. If the determiner for green pod color is substituted for that of yellow, the pods on such a plant are dark, deep, but rather dull purple. In the presence of colored flowers a seed may have a rich brown network pattern, called Maple, but if the flowers are white, the pattern shows so dimly that we refer to it as Ghost-maple.

We also have a fair understanding of the hereditary elements that primarily determine whether a plant shall bloom in fifty days from planting or very much later. We know that white-flowered plants in general are earlier blooming than those with colored flowers, irrespective of whether they are dwarfs or talls. The earliest bloomer of the several hundred varieties we have tested is in all cases Velocity, a variety with white flowers, and 10–15 long internodes (portions of stem between the leaves). From the internode standpoint, it belongs to the talls, although the trade refers varieties of this type to a class called half-dwarf. Many of the canner's peas belong to this general class. Our latest flowering varieties are Späte Gold (a white-flowered, very tall type from Germany) and "Ruby," a tall colored-flower type with peas that are red when immature instead of the ordinary green. Colored flowers and late flowering on the one hand, and white flowers and early flowering on the other hand, are pairs of characters that, much of the time at least, are inherited together, though not always. This illustrates what we mean by speaking of the relations of characters to each other in inheritance. We are able to tell by the color of the seed whether the plant will produce pink, red-purple, or white flowers, because there is practically an absolute association in inheritance between certain seed-coat colors and certain flower colors.

Understanding of the manner of inheritance of pea characters

places us more and more in a position to combine many characters together in a very definite fashion. In mapping the hereditary make-up of peas, we have been combining the characters of various varieties into one variety, so as to make it unnecessary to deal with so many kinds. We now have varieties that differ from each other in as many as thirteen clear-cut characters, the inheritance of each of which is comparatively simple. Of course, they differ in many more characters, but these others are complex in their hereditary make-up; just as in the inheritance of pod size, of yield, and of time of flowering, many hereditary determiners, as well as many environmental conditions, govern the coming into being of the last mentioned type of characters. For this reason, for some problems, they are not so desirable to work with. Some characters are very sensitive to apparently slight differences in environment; others are not. For example, flower-color, various seed-coat colors, flowers in bouquets or umbels at the top of the plant or distributed along the stems as in ordinary peas, seeds stuck together in the pod (chenilles) or free as in ordinary varieties, scimitar-shaped pods, or straight pods, and many others are comparatively insensible to ordinary changes in environment.

During 1926, studies on the inheritance of a new striping pattern of the seed-coat have, for the most part, been completed. This pattern, in the original form in which we obtained it, consisted of broad purplish stripes on a reddish gray seed-coat. The seed came from A. D. Darbishire (in England), who secured it from crossing a Chinese native pea with a form of "*Pisum umbellatum,*" a pink-flowered fasciated pea. He sent it to us as a true-breeding segregate for certain characters. So far as we know he never described it. We later obtained the same pattern from crossing a white-flowered Chinese pea that we obtained in Chinatown, New York City, with several colored-flowered varieties that we had produced ourselves. The Darbishire variety in our cultures is known as P 5, the white-flowered Chinese type from Chinatown is P 50. P 5, when crossed with a variety having pink flowers and non-striped seeds, gives all striped seed plants in the first hybrid or F_1 generation and a ratio approximately of 3 plants with striped seeds to one without in the

second hybrid or F_2 generation. These results indicate that the two varieties in respect to striped seed-coat differ by one hereditary factor, which we refer to by the symbol St. When the white-flowered P 50 variety is crossed with a number of colored-flowered varieties with non-striped seed-coats, a more complex situation obtains in respect to the inheritance of the striped pattern. The first hybrid or F_1 generation from such a cross has colored flowers and striped seed-coats, but the second hybrid generation or F_2 produces progeny that fall into two classes in respect to the inheritance of the striping pattern. Approximately nine out of every sixteen have striped seed-coats, while the remaining seven plants have no stripe on the seed-coats. One such F_2 family, out of 227 plants observed, had 131 with striped seed-coats to 96 plants with non-striped seed-coats, the theoretical expectation in this case being 127. + striped to 99. + non-striped. The striped pattern appears only on plants with colored flowers and colored seed-coats, but not all these, even in such a hybrid family, have striped seed-coats. Taking into consideration both the inheritance of flower color and striping in the cross mentioned above, the theoretical expectation, provided the two kinds of characters are inherited independently of each other, would be 9 colored-flowered, striped seed-coat; 3 colored-flowered, non-striped; 4 white-flowered, non-striped out of every sixteen second hybrid or F_2 generation plants. The results obtained approximate the theoretical expectations in general, though there is some question as to whether they indicate complete independence in inheritance of the two sets of characters. The relation of stripe to many other characters in peas has been studied.

Additional studies to those already reported on the inheritance of height in peas show that height is a very complex character and that talls crossed with dwarfs in some cases produce first generation hybrids that are not as tall as the tall parent. From such crosses, several types of dwarfs and talls are produced. Some of the dwarfs with colored flowers have proved to be about the latest flowering types we have found.

30

Inheritance Studies on Hollyhocks

By Orland E. White and Mary Ellen Peck

Studies on the inheritance of flower color, leaf shape, and other characters in this popular garden plant have been continued during 1926. A collection of the various types and varieties is being made to facilitate these investigations.

"Hardiness," Mutation, and the Geographical Distribution of Plants

By Orland E. White

My primary interest in this problem arose in connection with the idea that if mutations in plants take place in all directions and thus affect each kind of structure and function, there is no reason, *a priori,* to suppose that strictly tropical species may not produce mutants that would live in regions with much lower temperatures. In the January, 1926 number of the Brooklyn Botanic Garden Record, I published a short preliminary paper on this subject, outlining the problem and setting forth some facts and generalizations having to do with it. Since then I have been gathering data of a more specific nature. Such a problem is difficult to investigate, since it is only by the merest accident that one might discover such mutants by growing seed of tropical species under lower temperature conditions. Then, too, present methods of collecting seed of tropical woody or herbaceous perennial plants are unfavorable to bringing to light such mutants, because most seed collectors secure their seed of a given species from a very few individuals.

By searching through horticultural, gardening, forestry, and economic plant literature, and in other ways, data on this subject are being accumulated. Several cases of *Magnolia grandiflora,* hardy far north of its natural range, have been found. J. A. Neilson (Report Northern Nut Growers' Assoc. 1925, p. 63) states that there is a pecan tree growing on the grounds of Richard Martin, Hamilton, Ontario, which grew from a nut obtained from a tree in San Antonio, Texas, in 1914. The tree is now 18 feet high, 4 inches in diameter, and appears to be per-

fectly hardy. Trees of this same species over 50 years old, obtained from planting nuts from southern Indiana, are described by the same writer as hardy near Richmond Hill, Ontario, although they do not bear nuts except in the most favorable seasons. Z. H. Ellis, in the same volume, describes his experiments with pecans at Fair Haven, Vt. Most of his many attempts resulted in the seedlings winter-killing the first winter, but he has one tree, over 30 feet tall and a foot in diameter, that grew from seed obtained in Vermont. He states that it is the only pecan tree in his state. Recently, a 25-year-old Para rubber tree (*Hevea braziliensis*) has been discovered in an unprotected situation near Palm Beach, Florida (Official Record, U. S. Dept. Agric. **5**: 39, 1926). During this growth period, the account states, it must have withstood temperatures below freezing, perhaps as low as 24° F. to 28° F., and yet farther south, at Miami, there are records of trial plantings of this same species that apparently died from too low temperatures. Many less striking cases in other plants might be described, but these are reserved for a more extended and detailed account on this whole problem.

Here, I wish to bring out two more points which have to do with this problem. In searching for data, I thought the floras of various rivers might help, particularly those that flowed from a frost-free or subtropical region into a much colder one. But apparently there are no such rivers. They all flow from a cold region into a warm region, as most of the tropical rivers do, or from a relatively cold into a much colder region, as in the case of those flowing into the Arctic Ocean. In no case were rivers found flowing through enough ranges in temperature to make their floras significant for this problem.

The second point has to do with the ability of woody or herbaceous perennial plants to acquire immunity to cold without changing their hereditary constitution. M. J. Dorsey and J. W. Bushnell (The hardiness problem, Minn. Agric. Exper. Sta. Jour. Ser. Papers 242, p. 9) discuss this question in connection with the experiments of J. C. Whitten. Whitten obtained buds of Elberta and Old Mixon Free peach varieties from trees at different points between Michigan and Texas, and grew them at Columbia, Mo. In all cases, the trees grown from buds of the

same variety (hence having, generally speaking, the same hereditary constitution) reacted in a similar way as regards winter hardiness, no matter what their source. In other words, there appears to be no indication that a woody or perennial herbaceous plant can change its degree of hardiness, without changing its genetic makeup.

Iris Project

By George M. Reed

A statement regarding the Beardless Iris project established at the Brooklyn Botanic Garden in cooperation with the American Iris Society was published in the last annual report. During the past year continued progress has been made in carrying out the plans inaugurated. The season proved unusually favorable for abundant bloom of the Japanese varieties, and consequently it was possible to obtain good material for use in making varietal descriptions. A considerable number of new varieties were added to the collection during the year. The sources of these were as follows. The asterisk (*) indicates a purchase; all other items were received by gift.

*	Barr & Sons, England	53 varieties
	Elliott Nursery Co., Pittsburgh, Pa.	12 "
	Henry A. Dreer, Philadelphia, Pa.	12 "
	Julius Roehrs Co., Rutherford, N. J.	10 "
*	Vilmorin, Andrieux & Cie, France	29 "
	W. Atlee Burpee Co., Philadelphia, Pa.	5 "

The Siberian and other Beardless types also grew quite satisfactorily during the season, and abundant bloom was secured. Consequently, it was possible to check up on the proper identification of many varieties and species. During the year a number of additions were made. Plants of *I. longipetala* were donated by Mr. John B. Wallace, Jr., New Haven, Conn., and Mr. Robert Wayman, Bayside, Long Island, and also plants of *I. dichotoma* by Mr. H. S. Jackson, Lafayette, Ind. *I. laevigata* was purchased from Mr. J. A. Kemp, Little Silver, N. J. Siberian varieties were received as follows:

Frank W. Campbell, Detroit, Mich.	5	varieties
Mrs. W. G. DuMont, Des Moines, Ia.	2	"
Robert Wayman, Bayside, L. I.	1	"
W. Atlee Burpee Co., Philadelphia, Pa.	2	"

Mrs. J. Branin, San Lorenzo, Calif., sent seven varieties, mostly of the Spurian type and of her own origination. Mrs. L. W. Hitchcock, New Rochelle, N. Y., sent four seedlings of *I. versicolor* and *I. orientalis.*

Miss Maud H. Purdy painted a number of illustrations of different varieties of Japanese and Siberian Irises. These illustrations supplement those which were prepared during the previous year. They are of the same high order of excellence and serve to greatly extend the range of illustration of color and form in the varieties of these groups.

Studies of the variation of the Boston Fern (Nephrolepis)

By Ralph C. Benedict

Experimental work on *Nephrolepis* forms has been continued along the lines of previous years; namely, the maintenance of the numerous bud variations for further observation, and the experimental culture and study of various forms derived from the spore-fertile strain. In both these groups are many forms of special interest, either because they are new, or undescribed, or insufficiently studied. The whole collection of the *Nephrolepis* variations is urgently in need of more extensive and intensive study. I want here to offer some observations on the present status of the work, and on certain potentialities of further study of this group.

It is just about thirteen years since I first became interested in these ferns in connection with the preparation of a description of the cultivated ferns for the *Cyclopaedia of Horticulture.* It is just over twelve years that the hospitality of the Brooklyn Botanic Garden and the facilities of greenhouse space were first made available. During the succeeding years my study of these ferns has involved the assembling of hundreds of different types for experimental culture and study at the Garden. In this work I have visited practically all the commercial florists who have in-

troduced new types in the United States, and by purchase and exchange, have obtained most of the named types listed by English and French growers which were different from local kinds.

Taking stock of what has been done, and considering other possibilities, let me offer an analysis of the present status of this *Nephrolepis* investigation, and some definite recommendations.

(1) *Maintenance of the Botanic Garden Collection.* I think it is entirely safe to say that nowhere else has there been gathered so large and complete a collection of Boston Fern variants. Considering the fact of the evolution of this group of hundreds of distinct forms from one single form in less than twenty-five years, and considering the fact that many of these types are no longer obtainable from the florists who originally introduced them, it seems to me that the preservation of as large a set of distinct varieties as possible is a most desirable aim. This is particularly true in view of the fact that the study and descriptions of these forms have so far been necessarily brief and superficial. Herbarium specimens are most inadequate to preserve the important distinctive features, even of many leaf characters.

(2) *Description of Named Types.* As noted above, most of the varieties have so far been described only sufficiently to show their relation to the lines of variation among the hundreds of types. From the horticultural viewpoint, a monographic description of the named forms, with special consideration for their cultural characters, would seem worth while. From the scientific point of view, careful study of gross structure, of tissue- and cell-differences, would contribute greatly to our understanding of the basic differences between varieties.

(3) *Comparative Anatomy and Morphology of Feral and Horticultural Types.* Coincident with the assembling of the horticultural forms, attention has been paid to getting together as many wild forms as possible, and a number of types have been obtained directly from the American tropics, as well as other wild types obtained through florists. Parallel studies of the variation among the wild types as well as among the cultivated forms offer some very interesting possibilities. In this connection the basis for a much needed taxonomic monograph of the genus would be afforded.

(4) *Cytology of Sports.* Are there nuclear differences corresponding to the wide external differences among these mutations? The serial nature of much of this Boston Fern mutation, the repetition of definite new types, the parallel variation—all these facts arouse interest in the possibility of correlated cytological differences.

(5) *Cooperation with Florists.* "What Boston Fern is best?" was used as the title of my series of articles in the *Florists' Exchange* and in other periodicals. In that connection sample sets of named varieties were distributed to a wide list of commercial florists and to agricultural colleges and experiment stations. A continuation of this cooperation would also afford the opportunity, if properly organized, for the thorough testing, horticulturally, of a large number of old and new varieties, for which the greenhouse space at the Botanic Garden is necessarily insufficient, as well as contributing to the advancement of horticultural knowledge.

(6) *Further Studies in the Variation of Boston Fern and Other Fern Types.* The potentialities of the production of new types in the Boston Fern series are far from exhausted. In the spore-fertile group, it would be possible to raise new distinct types by the score within the next year. At present there is a considerable number of such forms, raised at the Garden, both of the *fertilis* strain, and among the bud-sports, which only wait for the time needed to prepare descriptions and discussion for publication.

Regarding my own connection with the lines of study thus analyzed, I am hopeful that opportunity may offer which will allow me to take leave of school work for a term or two and thus to give more concentrated attention to the problems suggested. At the same time, there would be involved considerations of greater expenditure by the Botanic Garden for publication, illustration, greenhouse space, gardeners' time. For my own time, I cannot speak definitely, except that it would be necessary for me to make up any difference between my regular school salary and that which I might receive on the basis now allowed by the Sabbatical leave arrangement of the city Board of Education I have hoped that an arrangement along these lines might be possible with the Botanic Garden.

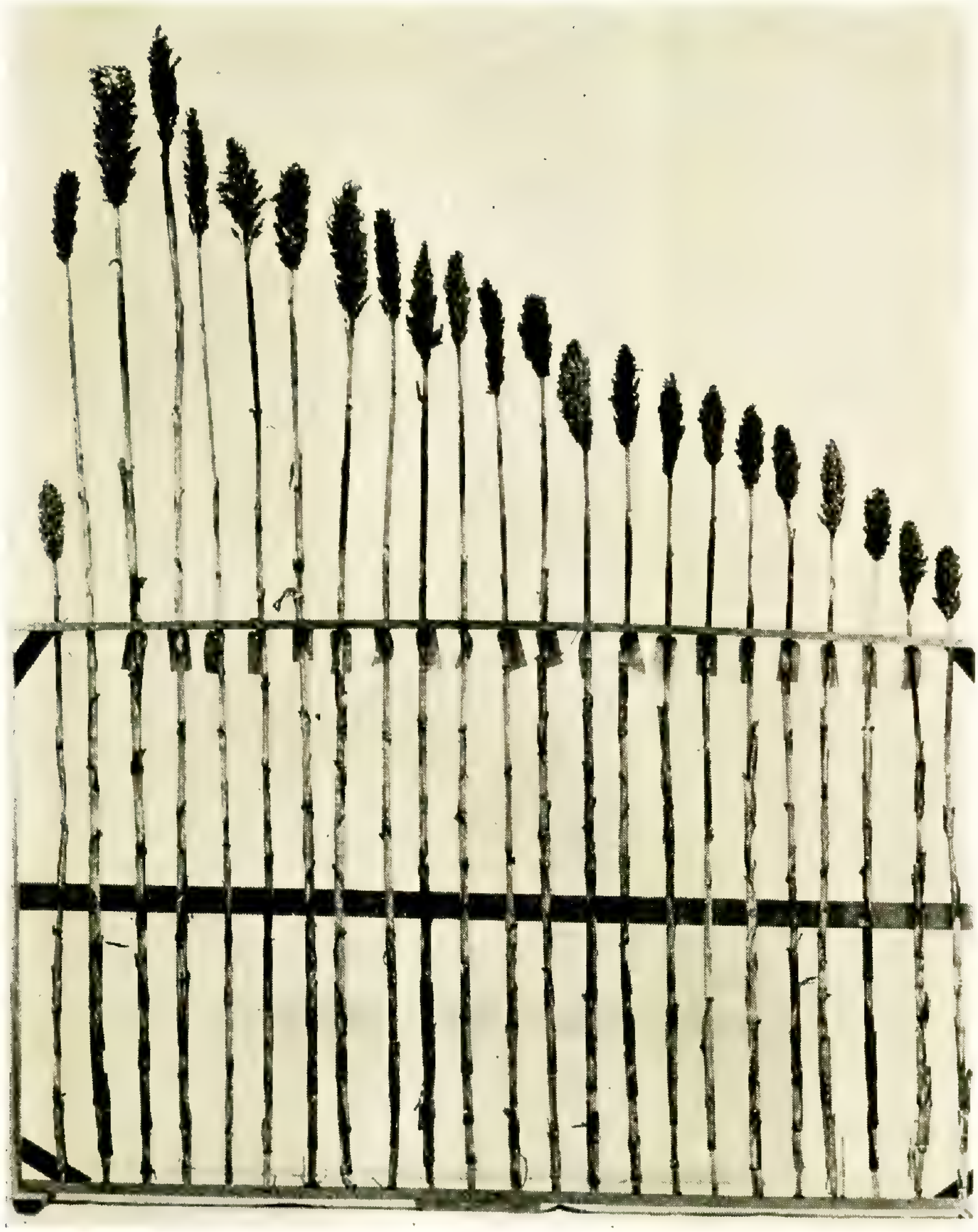

FIG. 5. Sorghum Hybrid (Feterita × Sumac Sorgo). At the extreme left is a stalk of Feterita, an excellent grain sorghum, with large white kernels, whose average height is 4 to 5 feet; it is very resistant to covered kernel smut. The second stalk from the left is Sumac Sorgo or "Red Top," a sweet sorghum with small and dark reddish brown kernels. It averages 5½ to 6½ feet in height; it is very susceptible to covered kernel smut. The third stalk from the left is the first generation hybrid (F_1) between Feterita and Sumac Sorgo. It is taller than either parent, the panicle is larger, and the kernels are intermediate in size and color.

The remaining twenty plants are the offspring of Number 3, or the second generation hybrid (F_2). These are arranged to show the great variation in height, the size and shape of the head, and the size and color of the grain. Their descendants show various combinations of the characters of Feterita and Sumac Sorgo such as height, pithy or juicy stem, white or colored and large or small kernels, and resistance or susceptibility to covered kernel smut.

Plant Pathology

By George M. Reed

Comparison of the Loose and Covered Smut of Oats

The two smuts of oats, loose (*Ustilago avenae*) and covered (*Ustilago levis*), are distinguished from each other by morphological characters, pathological symptoms on the host, mode of distribution of the spores and, to some extent, the time of infection of the host. The spores of the two smuts are very similar in size and shape, but they can be distinguished from each other by the fact that the spores of the loose smut are roughened or spiny while those of the covered smut are smooth. The loose smut causes a more or less complete destruction of the head or panicle of the infected plant, practically all of the parts being destroyed and converted into a dusty mass of spores. These spores are usually distributed in the field during the flowering period of the oats. As a result, they are largely scattered by the wind before the grain is ripe and ready for the harvest. Recent investigators in Europe have studied the possibility of some type of flower infection in the loose smut. Since the spores are distributed in the field during the blossoming period of the plant, it has been suggested that they are carried to the young developing flowers. There is considerable evidence that they may be thus carried, and find lodgment within the glumes, where they germinate and develop into a mycelium. When the seed is planted in the soil and germinates, the young seedling is penetrated by the further growth of the smut mycelium. It has, however, been clearly demonstrated that infection by the loose smut may also take place in the seedling stage by means of spores adhering to the grain. In our studies, the regular method of inoculation has been the application of spores collected during the previous season to the dry oat seed. The fact that very commonly we have secured 100 per cent. infection is conclusive evidence as to the infection of the seedlings by spores present on the exterior of the grain.

The covered smut causes a less complete destruction of the head or panicle. The outer glumes of the spikelets usually persist

and enclose the spores, thus giving the common name to the smut. These spores remain enclosed until the harvesting and the threshing operations, at which time they are more or less broken apart and scattered upon the sound grain. When the contaminated seed is planted, infection takes place in the young seedling by means of these spores adhering to the grain.

For several years extensive studies on the resistance of oat varieties to these two smuts have been carried on. A very complete collection of oat varieties from all over the world, belonging to all the main groups of cultivated oats, has been used in these experiments. It has been found that most of the varieties of the common, or Sativa, type are susceptible to both species. As a rule, if a variety is susceptible to one species it is also susceptible to the other, and if it is resistant to one it is resistant to the other. Several varieties of oats, however, have been found which appear to be more susceptible to the loose smut than to the covered, and a very few varieties have proved to be more susceptible to the covered smut than to the loose. During the past year the behavior of these has been further studied, and additional data on their resistance or susceptibility to the two smuts have been obtained. The varieties Black Diamond, Black Norway, Danish, Danish Island, Early Gothland, Green Russian, Irish Victor, Japan, Monarch Selection, Scottish Chief, Trisperma and White Queen have proved to be highly susceptible to the loose smut, usually giving 100 per cent. infection, but they have given either negative results or low percentages of infection with the covered smut. On the other hand, Monarch has proved to be very susceptible to the covered smut, while showing a high degree of resistance to the loose. The cultivated oats derived from *Avena sterilis* have shown a high degree of resistance to both smuts. Some cultivated varieties of *A. strigosa* are equally susceptible to both, while other strains possess a high degree of resistance. *A. brevis* is highly resistant to the loose smut, but has given some infected plants with the covered, and *A. barbata* and *A. fatua* have proved to be very susceptible to both smuts.

Physiologic Races of Oat Smuts

The results described in the above paragraph were obtained by using collections of loose and covered smut originally made in Missouri. One of the most important discoveries in our study has been the fact of host specialization of both species of smut, and further investigations along these lines have been continued. Collections of spores from various regions have been secured and have been tested out on a number of different varieties of oats. It has been clearly demonstrated that there are many distinct races of both loose and covered smut, characterized by their different behavior on certain oat varieties, and they can be sharply distinguished from each other by differences in their capacity for infection.

While a number of new races have been more or less delimited during the past year, the new races of loose smut on Fulghum and Red Rustproof oats are probably most interesting. These varieties are derived from the species *A. sterilis,* being grown quite extensively in the southern United States. While particularly adapted to the winter oat section, some strains of these varieties are proving well suited to the more southern spring oat section. They are quite distinct from the *A. sativa* type, which includes most of the varieties grown in the main oat belt in the United States and Canada. Outside of the southern oat section these varieties have a reputation for being remarkably free from smut. In our previous studies, the races of smuts used have failed to produce any marked infection of either Fulghum or Red Rustproof. Three collections of smut, however, were obtained from the south, one each from Tennessee, Texas and Oklahoma, which have shown a marked capacity for infecting Fulghum. In our experiments six different strains of Fulghum were grown, and the percentage of infection varied from 53.6 per cent. to 97.8 per cent. The Fulghum race of smut is further characterized by its ability to infect Hulless, Black Diamond, Canadian, Early Champion, and, to some extent, Early Gothland and Monarch. It did not, however, pass over onto Red Rustproof.

A single collection of smut was obtained from Texas on Red Rustproof. This collection proved capable of infecting five dif-

ferent strains of Red Rustproof, the percentage varying from 25.9 per cent. to 70.8 per cent. While an occasional plant of some other variety was infected, the evidence is that the Red Rustproof race is largely confined to strains of this variety.

The extensive specialization of both loose and covered smut greatly complicates the studies on varietal resistance as well as rendering more complex the study of inheritance of smut resistance in hybrids. Certain varieties seem to be susceptible to a very large number of races, such as Canadian, Early Champion and Victor. The variety Monarch has proved quite resistant to the Missouri race of loose smut, but shows some susceptibility to the newly described Fulghum race. It is particularly interesting that so far Black Mesdag has proved entirely resistant to all the races studied.

Inheritance of Smut Resistance in Oats

Studies on the progeny of a cross between the very resistant Black Mesdag and the susceptible Hulless varieties have already been published. The second and later generations of this cross were studied with reference to their behavior towards the Missouri race of loose smut. Additional crosses between these two varieties have been made, and during the past year the data on the second generation have been obtained, the results confirming those previously published. In the four families studied, the percentage of infection varied from 19.1 per cent. to 25.8 per cent., 107 plants out of a total of 465, or 23 per cent., being infected. Additional second generation plants of these same crosses were also tested with the covered smut, and the percentage of infection varied from 12.2 per cent. to 26.5 per cent., 40 plants out of a total of 196 inoculated in all the crosses, or 20.4 per cent., being infected.

The second generation of crosses between varieties, both of which were susceptible to loose and covered smut, have also been studied. One of these crosses was between Victor and Canadian, and the other between Hulless and Silvermine. All the plants inoculated in each experiment proved to be susceptible, 100 per cent. infection being obtained. A cross between Victor, which is susceptible to both smuts, and Early Gothland, which is sus-

ceptible to loose smut but resistant to covered, was also studied in the second generation. All the plants inoculated with loose smut were infected, while of the plants inoculated with covered smut, 18.1 per cent. were smutted.

Varietal Resistance and Physiologic Specialization in Bunt of Wheat

For a number of years studies on the bunt of wheat caused by *Tilletia tritici* and *T. laevis,* with particular reference to varietal resistance, have been carried on. Dr. James A. Faris, formerly Resident Investigator at the Brooklyn Botanic Garden, published his studies on these two species, his experiments being concerned primarily with determining the influence of certain environal factors on infection, such as temperature, moisture, soil reaction, etc. In the course of his studies, however, he found some evidence of a host specialization of these smuts. These clues have been followed up and a large amount of additional data has been obtained. The evidence is now clear that both species of bunt of wheat contain highly specialized races which are distinguished by their capacity for infecting certain varieties of wheat. The variety Martin, which has shown a high degree of resistance to the usual collections of bunt, has proved to be quite susceptible to some collections of spores. Additional experiments are in progress to determine more completely the limits of some of these races.

Experiments with the Covered Kernel Smut of Sorghum

The main studies during the past year have been concerned with a continuation of the investigations on the inheritance of resistance of certain crosses between sorghum varieties to the covered kernel smut. A large amount of additional data has been secured on the second, third and fourth generations. A cross between the very resistant Feterita and the susceptible Sumac Sorgo seems to indicate that susceptibility is dominant and resistance recessive, since a large proportion of the second generation plants are infected. During the past year, in one cross 69.6 per cent. and in another 67.1 per cent. of the plants were smutted, as compared with 86.1 per cent. of the plants of the

susceptible parent, Sumac Sorgo, and no infection of the resistant Feterita. The third generation families have shown great variation in the amount of smut, some being entirely resistant, while others are very susceptible, and the morphological characters of the two parents are variously combined with the quality of smut resistance or susceptibility.

The cross between White Milo and Blackhull Kafir seems to indicate that resistance is dominant and susceptibility is recessive. During the past season 17.1 per cent. of the second generation plants were infected, as compared with 47.7 per cent. of Blackhull Kafir and no infection of the White Milo. The infection of the Blackhull Kafir varied greatly in the different experiments, the highest obtained being 66 per cent. In the third and fourth generations we find various combinations of characters, several greatly resembling Blackhull Kafir, but showing a high degree of resistance.

A very serious difficulty in the study of this problem has been that of securing infection of the maximum number of susceptible plants. We have not been able to devise methods for use on a large scale which are successful in securing the infection of all susceptible individuals. During the past year, Sumac Sorgo has given a higher infection than usual, while, on the other hand, the results with the Blackhull Kafir have been below those of previous years.

Additional crosses between various sorghums have been made and the first generation was grown during the past season. The second generation will be available for study during the coming year.

Head Smut of Sorghum and Corn

This fungus is particularly interesting because of its occurrence on both sorghum and corn. The studies reported upon last year have been continued. Various methods have been employed to secure infection, which have involved for the most part variations in the age of seedlings and in the culture of spores in the soil. Various combinations of spore-soil cultures and seedlings of different ages have been carried out. Unusually severe infections of corn with spores from corn occurred throughout a

wide range of conditions. The highest infection secured was 91.6 per cent., although infections above 80 per cent. were fairly common. Similarly, the Red Amber Sorgo proved to be very susceptible to spores from sorgo, the highest infection obtained being 84.6 per cent. In 1925 there was no infection of sorghum with spores from corn, nor infection of corn with spores from sorghum. During the past season, however, some evidence was obtained to indicate that the smut from corn could pass over onto sorghum, since in a few experiments the sorgo inoculated with spores from corn were infected, the highest percentage being 20 per cent. Similarly, a few corn plants inoculated with spores from sorghum were also infected, the highest percentage being 10.7 per cent. in one experiment. These results indicate that to some extent, at least, the smut from one host can pass over onto the other.

Iris Diseases

The disease of Iris, which is characterized by the destruction of the fibrous roots, proved to be very severe during the past season, a large number of the bearded varieties being severely injured and prevented from blooming. The disease is characterized by the decay of the fibrous roots, which prevents the plant from getting water and essential nutrients from the soil. As a rule the rhizome remains fairly healthy. Miss Marjorie Swabey, Research Assistant, carried out a large number of experiments with a view to finding a remedy for the disease. Several of them proved effective. They were, however, all radical, as they involved the lifting of the rhizome, its treatment and subsequent replanting. While the variety may be preserved by this process, yet the operation is destructive to bloom during a particular season. It was found that if the rhizomes were lifted, cleaned and exposed to the sun for a few days, and then replanted in a new soil they generally put out roots and leaves and fully recovered from the trouble.

Cryptogamic Herbarium

Only a few additions were made to the Cryptogamic Herbarium during the past year. The last two centuries, containing two hundred specimens, of the *North American Uredinales* were

FIG. 6. Bed of "Four-o'clocks" (*Mirabilis jalapa*), used in the Ecological Garden to illustrate Mendel's laws of heredity. (6014.)

added by purchase. We also secured seventy specimens of *Ustilagineen Europas,* issued by H. Zillig. Nine specimens were received from the Museum of the University of Cluj, Rumania, on exchange. Dr. Herman Poeverlein of Speyer, Germany, sent us one hundred and twenty-eight specimens of rust on exchange.

Forest Pathology

By Arthur Harmount Graves

Chestnut Bark Disease Investigations

In the work of 1925, the results of which have been published elsewhere (*Science* **63**: 164–165. 1926; and *Phytopathology* **16**: 615–621. 1926), it was definitely established, through the data resulting from inoculation work, that the roots of the chestnut are more resistant to the blight fungus than the trunk, branches, or basal shoots. The cause of this greater resistance of the roots was referred hypothetically to the known greater quantity of tannin in the root tissues, the published statement being as follows: "In view of previous work indicating an inhibitory effect of tannin on the growth of fungi, it is suggested that the greater resistance of the root tissues may be due, at least in part, to their greater content of tannin compounds or of substances associated with tannin." (*Phytopath.* **16**: 620.)

However it is possible that the comparative lack of air, as well as other external factors which are materially different in the ground and in the atmosphere, may produce a retarding effect on the growth of the fungus in the tissues of the host below the surface of the soil.

During the past summer, in order to test the effect of these external factors, three series of inoculations were made, in each case on an equal number of roots, and trunks or shoots of the same tree. In each series, after inoculation, the roots were treated in a different way, as follows:

Series I. Left exposed to the air.
Series II. Covered with soil.
Series III. Covered with dead leaves.

It is proposed to let these inoculations run for a year before the growth measurements of the fungus are taken, in order to make them comparable with the previous experiments.

Reports still continue to come in of nuts borne on coppice or basal shoots of blighted trees which, as before stated (Brooklyn Bot. Gard. *Record* **15**: 59), is an encouraging indication that the chestnut has yet a long lease of life. As long as it is able to reproduce by sexual methods, the probabilities of its becoming extinct are very slight.

Nectria Canker

This is the most serious disease of the Black or Sweet Birch (*Betula lenta*)—certainly in Greater New York and vicinity and northward, and probably throughout the whole range of the Black Birch. During the last six years we have seen several large birches die out from this cause in Prospect Park (Brooklyn). The most apparent symptoms are rough areas on the bark of the trunk or branches. On the trunk these areas are sunken and often covered by old bark. Where this outer covering has broken off, the canker, if of typical form, appears as a deep pit, lined with successively receding concentric rings or ellipses of wood somewhat like the tiers of seats encircling an amphitheatre, these annual recessions representing apparently the periods of advance of the fungus in the healthy tissues of the tree. The deep central point of the canker represents the place of original infection by the fungus, and although in an old canker it may be deep in the trunk, nevertheless, at the time of infection, years ago, it was probably at or near the surface. As is evident, the disease progresses slowly, and the affected tree may live for a long time. A large tree near Whitestone, L. I., with a trunk of about 2½ feet in diameter breast high, had a canker about 1½ feet in diameter. Where small branches or twigs are affected they often appear considerably swollen. The fruiting bodies of the fungus [*Creonectria coccinea* (Pers.) Seaver], which causes the trouble, appear during September or October, scattered singly or in twos or threes in crevices in the rough bark bordering the canker. They are very tiny, but can be distinguished by the naked eye (being a little less than ½ mm. in diameter), appearing as small,

bright crimson dots. In reality they are ovoid in shape, as can readily be seen with a good hand lens. During the winter they can usually be found at the margins of the cankers. In the summer season I have found another type of spore (conidia) borne on the surface of the diseased tissue. I have found the Nectria canker affecting also the Paper Birch and Yellow Birch in Maine. Experimental studies (Brooklyn Bot. Gard. Rec. **15**: 59. 1926) have shown that the same fungus is the malefactor here. There is reason to believe that the gray birch is also susceptible.

No remedies seem to be practicable as far as cankers on the trunk are concerned, unless one wishes to subject the tree to the rather expensive process of cutting out of the diseased area. Even in this case, one could never be certain of removing all of the diseased wood, and furthermore, an unsightly cavity would be left. (We do not subscribe to the practice now in vogue of filling cavities with cement, etc.) However, in case small twigs are affected, they should be removed as soon as possible, making the cut some distance below the affected area, *i.e.*, toward the trunk of the tree. The diseased parts should be burned, in order to destroy the spores, and the cut ends of the twigs on the tree should be promptly painted over with ordinary lead paint to prevent fresh infections.

For owners of woodlands the only practicable measure is to remove these diseased trees at the earliest convenient opportunity —either during improvement thinnings or during any other cutting. Thus the fungous spores will be prevented from infecting the sound trees, young and old, that otherwise are almost certain, sooner or later, to contract the disease. The diseased portions, and particularly the bark surrounding them, should be burned.

To determine the rate of growth of the fungus in the tree and also its effect on the timber, as well as other data, inoculations on healthy sweet birches on land of the writer in Hamden, Conn., were made in 1918. These cankers have grown slowly ever since, but beyond inspection of them each year, no further work has been done.

In October, Dr. Perley Spaulding, of the U. S. Department of Agriculture, informed the writer that he had observed what was apparently the same disease causing much damage to Yellow

Birch (*Betula lutea*) near Bolton, Vermont. On a subsequent trip to Brooklyn and examination of Sweet Birches affected with the canker in Prospect Park, as well as some of the dried specimens belonging to the writer, Dr. Spaulding said that he believed the Yellow Birches were affected with the same trouble.

Systematic Botany

Frankeniaceae. By Alfred Gundersen

During 1926 I have continued studies of the structure of flowers as related to the general classification of dicotyledons. I have given special attention to the Frankeniaceae, a small family of widely distributed subtropical plants of both hemispheres The striking resemblance of the pinks (*Dianthus*) to the Frankenias was recognized by the earlier botanists: Linnaeus, Jussieu, DeCandolle, Bentham and Hooker. In the Engler system, however, the Pink Family was moved near the Goosefoot Family, doubtless also a natural connection. Thus it came to be widely separated from the Frankeniaceae. A recognition of the natural relationship of Pinks and *Frankenia* would involve important changes in the grouping of dicotyledons. It would necessitate the moving of the families of Goosefoot Amaranth, Purslane, Pink and others to a position more advanced than the Frankeniaceae; and a rearrangement of Engler's sequence of these families would be required. Preliminary results were presented before the Torrey Botanical Club in February. On my European trip I have continued these studies and have obtained numerous specimens of the Frankeniaceae.

Ecology and Plant Geography

By Norman Taylor

Vegetation of Long Island

While field work had to be restricted because of lack of funds, active work on this project was continued at the Garden. Studies of soil fertility, humus accumulation, and hydrogen-ion concentration carried on during the year indicate that there is a definite relation between the stage of succession of the vegetation and the

accumulation of available nitrogen in the soil, and that some time-scale for such a process can be worked out.

Work was also continued on the climatic factors that affect the distribution of vegetation on Long Island, and the accumulated material and notes written up in a paper on "Climate of Long Island: Its relation to forests, crops and man," which was accepted for publication as a *Bulletin* of the New York Agricultural Experiment Station at Ithaca.

In an island as short as Long Island, it is surprising that there is enough diversity in the climate to affect the distribution of plants, of crops, and of man. But such is emphatically the case. The extreme eastern end is cooler by 8° to 10° in summer and has a shorter frost period in winter than the western end, and resembles more nearly a true maritime climate. Its isolated position, surrounded by cool sea water, makes it relatively free from the sudden cold snaps, that, originating on the continent, strike western Long Island with some violence.

Studies on the temperature of the sea water show that at Montauk it is from 4° to 10° cooler than the sea water near New York, and the effect of persistent southwest winds over this cool water makes summer temperatures so attractive that the resort value of the region from the Hamptons eastward is based upon this fact. One marked effect of this sea water on eastern Long Island is its relation to potato planting in the spring, and brussels sprouts harvesting in the fall. During March, April, and May, the cool water makes conditions on land admirable for early potato planting and young growth. So marked is this coolness that the lilac and other plants habitually flower from 8 to 12 days later there than in Brooklyn. In the late autumn the accumulation of summer heat in the sea water makes the first killing frost at Montauk and Orient come 10 to 20 days later than on western Long Island —an obvious harvesting asset.

It is, also, only at this relatively cooler end of the island that we find a few wild plants of far northern affinities. Whether relicts of glacial times, or dropped by migratory birds, the persistence of plants like the crowberry, the red spruce, the sea lovage, and a few others, is undoubtedly due to the fact that temperature conditions at the eastern end are vastly different from those at the western end of Long Island.

Flora of Long Island

Almost no field work was done during the year, but herbarium studies were continued. Collections from Mr. William C. Ferguson, Mr. Roy Latham, and Mr. E. S. Miller were mounted and added to the Long Island herbarium, as well as considerable material of older collections, which has been identified. All these records have been posted on the distribution maps of the manuscript "Flora of Long Island."

FIG. 7. Maize. Two inbred parent strains, one on each side; their first generation (F_1) hybrid progeny represented by the two central rows. (6017.)

REPORT OF THE CURATOR OF PLANT BREEDING AND ECONOMIC PLANTS FOR 1926

DR. C. STUART GAGER, DIRECTOR.

Sir: I beg to submit herewith my report for the year ending December 31, 1926.

In addition to the investigational work on field and garden peas, and hollyhocks, and on hardiness in woody and herbaceous perennial plants, mentioned in the Reports on Research for 1926 (p. 00), I have continued in charge of the "Ecological Section"—with its various beds of exhibits and demonstrations designed to show how plants are fitted to meet the problems of existence. Many of the most curious plants in the Garden collections are to be seen growing here. The section comprises several types of environment and ultimately more are to be added, in the form of Old and New World desert plots with some of the plants that typically characterize them. At present, the different types oi plant surroundings are represented by a small bog, a swamp, a section of a brook, and beds with ordinary and other types of soils. The bog contains sundews and pitcher plants and needs to be extended and improved and made much more naturalistic. The swamp contains a multitude of typical swamp and shore-line plants, the whole area being dominated in naturalistic effect by the European wild Yellow Flag, the floating water fern (*Azolla*), arrowheads (*Sagittaria*), and the tropical Water Hyacinth (*Eichornia*) that is such a problem to river navigation in some of the warmer parts of the world. A fine clump of *Orontium aquaticum* or Goldenclub is one of the newer features of this area. The small island has been planted to English ivy, and during the next summer it is planned to infest it with a luxuriant growth of Dodder (*Cuscuta*). During the last two years a species of this orange-colored parasite has been found to grow well on this ivy. The contrast between the colors of the two plants gives a very striking effect, and thus intrigues the casual visitor into a desire for more intimate details of what he or she sees.

Among the more interesting and curious plants in the beds west of the swamp are the ant-feeding Bull's-horn Thorn (*Acacia*) of

Central America, whose place in the scheme of things in that world is so graphically described by Thomas Belt in "The Naturalist in Nicaragua." These plants in their natural home and the ants form a mutual aid society, according to Belt—the ants protecting the plant and the plants furnishing food and housing. The food consists of honey and of little yellow fruit-like bodies that are said to be highly nitrogenous, and grow at the tip of each tiny leaflet.

The Edible-stemmed Grape (*Vitis quadrangularis*) is another bizarre tenant of this section. It comes originally from northern Africa and the warmer parts of Asia, and its stems are used for food in India, instead of its fruit. Its stem is very succulent and this, together with its small insignificant leaves, often leads even plant specialists to mistake it for a cactus or euphorbia. Part of a bed is devoted to the common tropical Sensitive Plant (*Mimosa*); and in other beds there are specimens of the Castor Bean plant (*Ricinus*), with its exploding seed capsules; the Squirting Cucumber (*Ecballium*), that shoots its seeds from a ripe fruit with considerable force to a distance of ten feet or more; the Spanish Bayonet (*Yucca*) with its indispensable, black-eyed, silver gray little moths; and Kentucky Hemp, with a blue-flower parasite (*Orobanche*) that lives on its roots and takes its toll of hemp plant food.

During the last year two new demonstration beds have been added, both dealing with inheritance problems. One of these plots consists of two exhibits, the plants used being Indian corn or maize. The first exhibit shows two inbred strains of maize and the much more vigorous and prolific progeny that result from crossing them (Fig. 7). The other exhibit involves two very dwarf (less than a foot high), but distinct varieties of yellow dent maize called "Nana" and "Dwarf." These, when crossed, give first generation progeny over seven feet high (Fig. 8). Both these exhibits attracted special interest. The seed from which they were grown was received through the kindness of the Department of Plant Breeding, Connecticut Agricultural Experiment Station, and Dr. D. F. Jones.

The other new demonstration feature of genetic interest was a bed of Four-o'clocks showing the results of crossing a yellow-

flowered variety with a pink-flowered variety, and illustrating Mendel's law of segregation. The two parents and, between them, the first hybrid generation plants were shown in the first row. The other two rows contained plants of the second hybrid generation, in the kinds and proportions of each theoretically expected when two pairs of Mendelian factors are involved. Thus in this cross, the two parents are yellow (YYrr) and rose pink (yyR^pR^p). The first hybrid generation plants have rose red flowers. The plants of the second hybrid generation are represented in the bed in the ratio in which they occur, by 1 deep crimson: 2 rhodamine purple: 2 scarlet red: 4 rose red: 1 yellow (like the parent flower color): 2 light yellow: 1 rose pink (like the male parent flower color): 2 light pink: 1 white. The colors, of course, refer to the flowers.

Four-o'clocks are especially fine material for illustrating Mendelian laws of heredity for a number of reasons. They are comparatively free from disease, easily grown, attractive in appearance, continuous bloomers, and they already have interesting associations for the general public, since they are flowers of the old-fashioned flower gardens and since their flowers open and close according to certain environmental conditions.

Furthermore, the tuberous roots live over winter easily when placed in a little sand in a dry, cool cellar, and farther south they live over out-of-doors. There are records of the roots living for over twenty-five years. The dome or mound-like habit of growth of the plants lends itself to orderly arrangement without distracting supports. Hence, the exhibit plot, appropriately labeled, can be arranged almost diagrammatically—the parents, F_1 (first filial), F_2 (second filial) generations, etc. In some regions such an exhibit bed could be enclosed with a low hedge of dwarf box or of other suitable materials. The plants are crossed easily. The flower colors are distinct and striking, and the heterozygotes (hybrid plants that do not breed true) of every genetic type are distinguishable by the beginner and the layman. Last of all, the great range of flower colors has a simple genetic basis—five factors in all, excluding the striping pattern—these being Y, R, R^p, y, and r. Our exhibit proved quite effective; though it should have had more sun. The plants for this exhibit came from Mr.

Francis P. Kiernan, one of our own employees, who has been interested in the genetics of Four-o'clocks for many years. A paper embodying the results of some of his studies recently appeared in *The Journal of Heredity* for October, 1926.

Another new feature of the "Ecological Section" is a bridge over the brook, just below the brook's exit from the swamp. This opens up a new and beautiful vista through the trees to those interested (Plate oo).

The section is situated in one of the most beautiful parts of the Garden, and as I have stated in previous reports, it falls far short of what it might be, because of a lack of expert gardening assistance.

For over three years, I have been interested in an aquarium culture apparently involving largely the alga, *Chlorela vulgaris* (?). This is a very minute green plant which is used frequently in physiological research. It multiplies enormously in an ordinary round glass battery jar under the usual light and temperature conditions of a dwelling or office. Generally my cultures have been kept in a north window, although for some months they did equally well or better in a west window. The culture under our conditions is practically non-odorous, and when kept in the proper dilution gives the appearance of a beautiful translucent rich green solution. During this period, four medium-sized gold fish have been domiciled in this culture jar, which is 12 inches high and 7¾ inches in diameter, and of about two gallons capacity. The water has been changed only by replacing that which evaporated, and once in six months or a year, the culture has been thinned, and the bottom and sides of the jar cleaned. During this period four ten cent cans of "Rainbow" or similar fish food have been used. The fish have remained apparently in perfect health. This note is presented at this time in the belief that these observations might be of practical value to those interested in household and other aquariums. It seems to me that an aquarium prepared in this manner would be more ornamental and of far less trouble than those in common use. The golden red fish against a velvety, rich emerald green is very striking, and the plant culture, when kept properly diluted, only serves to conceal the fish for part of the time. Professor Tracy Elliot Hazen, of Barnard College, determined the alga for me.

About one hundred new lantern slides, many of them colored, have been added to the collection of subjects for illustrating lectures and talks on economic plants.

As for several years past, I have been editor of the Genetics Section of *Botanical Abstracts,* which involves the editing, abstracting and securing of abstracts of several hundred scientific

FIG. 8. Maize, showing two dwarf parent varieties ("Nana" and "Dwarf"), one on each side; their very tall, vigorous, first generation (F_1) hybrid offspring between them. (6018.)

papers and books annually. In the new abstract journal, *Biological Abstracts* (which supersedes *Botanical Abstracts*), I have charge of the Plant Genetics section. In April, I was re-elected one of the officers and a member of the board of directors of the John Burroughs Memorial Association.

Numerous inquiries regarding economic plants, heredity, plant breeding, and South America have been answered, and I have given at various times and places public lectures on these subjects, as listed in Appendix 4.

Respectfully submitted,

ORLAND E. WHITE,
Curator of Plant Breeding and Economic Plants

REPORT OF THE CURATOR OF PLANTS FOR 1926

DR. C. STUART GAGER, DIRECTOR.

Sir: I beg to submit herewith my report for the year 1926.

Collections

Among plants of special interest added to the collections of living plants last year may be mentioned the California Tree Poppy (*Dendromecon rigidum*), the Chilean Beech (*Nothofagus betuloides*), and *Ternstroemia japonica.*

An inventory of conservatory monocotyledons, taken in January, showed the number of these, other than orchids, to be: genera, 162; species, 344; of orchids: genera, 27; species, 66.

The Iris Plantings have been in the special care of Dr. George M. Reed who reports as follows:

"The beds in the systematic section designed to show the different species of the genus Iris were completely overhauled. Many of the plants in these beds had been grown from seed and proved untrue to name. It was therefore necessary to completely rearrange the plantings. Additional species were added, and the beds now contain a fair representation of species which grow satisfactorily in this region. A number of Bearded Iris were also added to the collection during the year, all gifts. Mr. Robert Wayman, Bayside, L. I., sent us 51 varieties, Mrs. J. Branin, San Lorenzo, Calif., 1, Mrs. L. W. Hitchcock, New Rochelle, N. Y., 1, and W. Atlee Burpee Co., Philadelphia, Pennsylvania, 12 varieties."

Labels and signs were made by Mr. John McCallum as follows:

Labels and Signs

Steel labels for the herbaceous beds	324
Steel family labels for the beds	56
Lead labels for woody plants	11
Lead labels for conservatory plants	12
Large wooden labels for horticultural forms	20
Small wooden labels	233
Wooden signs	37
Cardboard signs	239
Total	932

Also numerous other miscellaneous numbers and signs.

An International List of Cultivated Plants

In correspondence which has progressed for about three years, a number of botanic gardens have expressed themselves as favorable toward the formation of an *International List of Genera of Cultivated Plants*. Our *Communication No. 7*, published in May, included letters from five gardens, and from Mr. J. Horace McFarland, chairman of the American Joint Committee on Horticultural Nomenclature. He proposes that "*Standardized Plant Names*," which follows in the main Bailey's *Cyclopedia of Horticulture*, and contains specific as well as generic names, should be adopted for some years, with such reservations as the various gardens may require. The *Communication No. 7* also contained a list of about 2500 generic names, following lines indicated as most generally acceptable, and a brief list of names frequently employed, as to which usage differs.

Immediately following the Ithaca International Botanical Congress, which I attended, I left for Europe. After some weeks in the mountains of Norway, I visited botanic gardens in Scandinavia, Germany, Switzerland, France, and England, a most interesting and instructive journey about which I will later report. The main object of my trip was to discuss with European botanists the possibility of the formation of an international list of plants. Plant lists are used by nearly every botanic garden. If similar lists could be used, the building up and maintenance of the most interesting collections would be greatly simplified. Various practical difficulties, climatic, historical, and financial, exist in the way of more effective international cooperation. Yet it is evident

that many botanic gardens would be disposed to make certain concessions in the direction of greater uniformity, at least in the matter of plant families and the most frequently used genera. In general, the smaller gardens appear to be disposed to follow the lead of the more important institutions in this matter.

Phanerogamic Herbarium

Among the collections acquired last year were 345 specimens from Mr. E. S. Miller, 121 Rumanian specimens from the Cluj Botanic Garden, 53 specimens from Kodiak Island, Alaska, from Mrs. B. Underwood, and 148 Florida specimens from Dr. H. J. Banker.

Lectures and Class Work

During March I gave three lectures on "Evolution in Flowering Plants." During May and June I conducted outdoor lessons on "Spring Flowers and Ferns," eight in the garden and eight at various points in the vicinity of New York.

Personal Activities

During the year I continued as chairman of the field committee of the Torrey Botanical Club.

Statistics

Living plants received during 1926:

	Plants	Species
By exchange	463	137
By gift	211	46
By purchase	783	113
Derived from seed	78	78
Total	1,535	374

Living plants distributed:

By exchange	70
To members	1,267
Total	1,337

Seeds received:

By exchange	882
By purchase	23
By gift	41
Total	946

Seeds distributed:

By exchange	1,893

Herbarium specimens received:

By exchange	121
By gift	559
Total	680

Respectfully submitted,

ALFRED GUNDERSEN,
Curator of Plants

FIG. 9. Penny Packets of seeds for school children. Messengers from various Public Schools getting the bundles of seeds ordered by their schools. Over 550,000 packets distributed in 1926. (5450.)

REPORT OF THE CURATOR OF PLANTS AND PLANTATIONS FOR 1926

DR. C. STUART GAGER, DIRECTOR.

Sir: I take pleasure in submitting my fifteenth and last annual report as curator of plants and plantations.

The work of the department during 1926 was largely of a maintenance nature, but some new work was accomplished:

1. Erection of new Botanic Garden signs at all the gates.
2. Two sets of wooden steps built at lower end of the esplanade.
3. Experimental enclosure between greenhouses and Washington Avenue prepared and fenced.
4. Two simple bridges built across the brook, one of stone near the ecological section, and one of concrete near the children's garden.
5. Grading south of the manure pit to increase size of the service yard.

The labor conditions, pointed out in my last report, remain the same, if anything, a little worse. Diversion of men, who should spend all their time in purely maintenance work, to the gardening force, or to the experimental enclosure, leaves the foreman undermanned for general work.

Personal Activities

During the autumn I visited Kew, the British Museum, and the Jardin des Plantes, at Paris. I have continued my association with the Long Island Historical Society.

Respectfully submitted,

NORMAN TAYLOR,
Curator of Plants and Plantations

REPORT OF THE HORTICULTURIST AND HEAD GARDENER FOR 1926

DR. C. STUART GAGER, DIRECTOR.

Sir: I beg to submit herewith my report for the year ending December 31, 1926.

In addition to routine maintenance, gardening work was as follows:

General Systematic Section

In continuation of the policy of clearly defining the limits of the Orders and Families of plants in this Section limiting hedges of the following plants were set out in the spring: *Prunus tomentosa, P. triloba, Spiraea* "Anthony Waterer," *Rubus odoratus, Ilex crenata* and *I. glabra.* These, in addition to fulfilling the purpose outlined above, will serve to show their value as unusual hedge plants.

The crowded condition of the trees and shrubs in the area allotted to the Apples and their relatives (Pomaceae) clearly called for drastic treatment so that individual specimens could have opportunity for proper development. As a result of a re-study of the adjacent areas by yourself, the Consulting Landscape Architect, and the writer, it was found possible to re-align the borders of the Magnoliaceae so as to provide more room for the Pomaceae. The work of thinning out the crowded trees and transplanting them to the new area was carried out in the fall.

Ornamental Planting

A large number of appropriate plants were set out in the rock garden, in the vacant spaces left by the removal of "filler" plants mentioned in my 1925 report. Some of this new material was derived from seed received in exchange from other botanic gardens, and a great deal as seeds or plants from the rich alpine collection of Mr. Clarence Lown of Poughkeepsie, who has always been most generous in his exchanges with the Botanic Garden.

During the summer thirteen new beds were made along the N.W. side of the avenue of Japanese Flowering Cherries to ac-

commodate bearded Irises—an overflow from the main plantation along the brook.

The planting that has been carried out in previous years is now paying dividends in the form of beauty—as witness the wonderful display of spring flowering bulbs naturalized in the lawns; the various flowering trees and shrubs, such as Apples and Cherries, Snowballs and Golden Bells; the Waterlilies, and the Hindu Lotus in the lake. The latter is now so vigorous that it became necessary during the summer to mow with a scythe the outskirts of the planting, lest it fill the whole lake. Some of the more quickly maturing shrubs are now assuming the proportions of "specimens," for example, the Harlequin Glorybower, *Clerodendron trichotomum,* illustrated on p. 14. Attention was directed to this particular specimen in a letter to "The Florists' Exchange" by Dr. Carl A. Schwarze, who described it as "a wonderful shrub . . . that looked like a huge bouquet."

International Seed Exchange

The 1926 Exchange Seed List was restricted to herbaceous plants, and seeds of 701 species, available for exchange in the spring of 1927, were collected in the Garden and elsewhere. The distribution of seeds (of trees and shrubs only) in the spring of 1926 to various countries is shown below:

TABLE I

Country	No. of Institutions	No. of Packets	Country	No. of Institutions	No. of Packets
Austria	3	44	Japan	1	22
Belgium	1	3	Jugoslavia	1	41
Canada	2	35	Lithuania	1	62
Central Asia	1	48	Poland	2	82
Czechoslovakia	2	88	Roumania	1	14
England	6	82	Russia	3	163
Esthonia	1	30	Scotland	1	14
France	11	280	South America	1	8
Germany	14	256	Spain	2	45
Holland	3	48	Sweden	5	129
Hungary	2	94	Switzerland	6	101
Ireland	1	11	United States	9	213
Italy	4	50		—	—
			Totals	84	1,963

FIG. 10. Shakespeare Garden, July 23, 1926. Members of the Botanic Garden Boys and Girls Club playing a game to see who can recognize and name the largest number of plants mentioned by Shakespeare. This garden was the gift of Mr. Henry C. Folger. (5956.)

Educational Work

In addition to several outside lectures, I conducted two courses for the general public at the Botanic Garden; namely, Gardening in the Fall, and Plants in the Home. In response to requests by various members of the Botanic Garden, I visited their gardens to give advice on garden problems, and many questions relating to plant culture have been answered at the Garden.

Respectfully submitted,

MONTAGUE FREE,
Horticulturist and Head Gardener.

REPORT OF THE CURATOR OF PUBLIC INSTRUCTION FOR 1926

DR. C. STUART GAGER, DIRECTOR.

Sir: I take pleasure in submitting herewith my report for the year ending December 31, 1926:

Classes, Courses, and Attendance

The total number of adults electing courses at the Garden during 1926 was 350. Of these, 234 were new. It has become increasingly desirable to learn the sources from which newcomers have derived their information about our courses. In order to get definite data, we issued to each registrant this year a card on which, among other things, was a questionnaire on this point. Of the 234 new students, 80 neglected to answer the questionnaire. The answers of the 154 others were distributed as follows:

Through friends, former students	52
From newspaper articles	41
From circulars sent out by the Garden (Including Brooklyn Teachers' Association circulars)	40
From Brooklyn Botanic Garden Prospectus	12
From Garden Bulletin Boards	9
Total	154

It seems reasonable to assume that the answers of the 80 registrants who failed to reply to the questionnaire would have been distributed more or less in the same proportion among the different sources. It is indeed gratifying to note that the most productive advertising we have is through the recommendation of people who have already taken our courses. It is also of interest that as many as nine metropolitan newspapers were named as sources of information.

Among our courses, the following were new developments in 1926. Dr. Gundersen gave an outdoor course on the spring flowers and ferns of the New York region, in which the parks and woodlands of Greater New York were visited by the class in much the same way as in my own classes on the woody plants. Dr. Gundersen's course was given on Saturday afternoons and proved popular.

Miss Shaw formed another division of her class in Greenhouse Work, which is really an advanced course for those who have already taken her Principles of Agriculture and Horticulture.

On account of the building of the new iron fence around the Garden and the replacement of the old turnstiles with new ones, definite figures of registration of visitors could not be obtained for the entire year. It was felt, however, that an arbitrary increase of 2 per cent.* over last year's figures would be a reasonably modest addition, in view of various indications that considerably larger numbers were visiting the Garden than in 1925. One of the indications was the increased attendance at the Conservatories —nearly 3,000 greater than last year, and larger than in any previous year. Now that the registering turnstiles are again in working order, the figures of the first months of 1927 amply justify this increase. In January, 1927, for example, the registration was 28,212—more than twice that of 1925, and larger than in any previous January in the history of the Garden. The following table gives the attendance at classes, lectures and conservatories, as well as registration at the entrance gates, by months, in 1926.

* This 2 per cent. increase was added beginning with May. The previous months have the 1925 figures.

TABLE II

ATTENDANCE AT THE GARDEN DURING 1926

	Jan.	Feb.	Mar.	Apr.	May	June	July
At regular classes	1,296	1,022	2,216	1,959	2,110	1,788	3,264
At visiting classes	169	12	1,263	5,584	14,702	2,742	0
At lectures to children	160	0	420	2,028	10,357	1,254	0
At lectures to adults	80	0	0	0	370	54	0
At conservatories	905	805	1,819	4,013	4,127	4,039	2,305
Total registration at gates	12,096	20,619	41,481	66,229	74,838	40,861	53,757

	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Totals
At regular classes	4,080	1,248	2,459	2,275	2,054	25,771
At visiting classes	20	0	7,209	4,209	1,582	37,492
At lectures to children	0	0	4,496	3,002	1,082	22,799
At lectures to adults	0	0	250	720	230	1,704
At conservatories	1,294	2,937	1,913	2,002	1,010	27,169
Total registration at gates	54,795	48,361	54,984	28,521	15,498	514,687

Demand for Study Material

The requests for plant material of various sorts for enriching the work in botany, biology, nature study, and geography in the various educational institutions continue to increase. A very urgent need is an additional greenhouse where material of this sort could be kept and grown. Because of the lack of it, many requests must be either refused entirely or else only partly supplied.

Because of continued poor health, Miss Charlotte Young, curatorial assistant, who had had especial charge of this part of our work from September, 1923, and under whose care and enthusiasm it had grown remarkably, was forced to resign as of April 1, and it became necessary for me to carry this work for a time without assistance, except for a few hours a week from high school pupils. Later, we were most fortunate in securing the services of Miss Hester M. Rusk, formerly of the New York Botanical Garden. Miss Rusk commenced her new duties on September 1 and is splendidly fitted both by training and experience for the work of this department.

Personal Class Work

The popular course on the Life of Plants, begun in 1925, has been continued, and while our equipment in the way of microscopes and accessories has been very meager, this condition, at the present writing, has been partly remedied. The popular outdoor classes on the Trees and Shrubs of Greater New York were given as usual, in the spring and fall, 61 people registering for the spring course and 41 for the fall course. As the concluding exercise of the fall course, a practical test in the identification of woody plants in their winter condition was held in the natural woodland at the north end of Central Park, Manhattan. In February and March, I gave a short course on the common native and cultivated trees on Saturdays to a group of 15 boys from the Boys' High School. I have conducted tests, as usual, from time to time, for Boy Scouts desiring to obtain merit badges in Forestry and Conservation.

Honey Bee Demonstrations

During the summer and early autumn, Mr. Frank Stoll, Registrar and Custodian, using the hives which are installed in the space between the two northern wings of the Conservatories, gave demonstrations of the life and work of the honey bee, opening up the hives and explaining the interior, as well as the functions of the workers, drones and queens. These demonstrations were made to groups from the Inkowa Club, the Department of Education of the Brooklyn Institute, to three classes from the Girls' Commercial High School, and to others.

Newspaper Publicity

This has been continued as usual on the same general plan of weekly releases of items of interest about the Garden, including the progress of scientific research, classes, work with children, plants in flower, additions to the collections, etc. In all, I wrote 72 articles on these subjects and sent them to the Metropolitan papers. In this work, Mrs. Warner, of the Brooklyn Publicity Bureau, has cooperated effectively during a part of the past year, especially during the campaign for the endowment fund. Through our clipping bureau we have received 513 items, not only

from New York papers, but from various parts of the country. Besides 18 papers and periodicals in Greater New York, these clippings have come from the following:

New York State:
Chronicle, Rochester
Syracuse Post Standard
Massachusetts:
Boston Herald
Christian Science Monitor, Boston
Springfield Republican
Connecticut:
Guide to Nature, Stamford
Hartford Courant
New Haven Union
New Jersey:
New Jersey Herald, Newtown
Pennsylvania:
Journal, Corry
Philadelphia Public Ledger
Pittsburgh Press
Maryland:
Sun, Baltimore
District of Columbia:
Nature Magazine, Washington
Washington Star
Washington Evening Star
Ohio:
Cleveland Times
Courier
Illinois:
Herald Examiner, Chicago
Louisiana:
Times Picayune, New Orleans
California:
Los Angeles Times
British Columbia:
"Province of Vancouver"

Editorial Work, etc.

During the year I was appointed Editor of the General Biology section of the new *Biological Abstracts*, the periodical which replaces *Botanical Abstracts* on which I served, with yourself, as Assistant Editor of the Botanical Education section. I have continued to serve on the editorial board of the *American Journal of Botany*. I have also edited the 1926 series of Brooklyn Botanic Garden *Leaflets*, consisting of 10 numbers. In August I attended the International Congress of Plant Sciences at Ithaca, N. Y., acting as the official delegate from the Torrey Botanical Club. In December I attended the annual meeting of the American Association for the Advancement of Science at Philadelphia. In January I was re-elected secretary of the Torrey Botanical Club.

Respectfully submitted,

ARTHUR HARMOUNT GRAVES,
Curator of Public Instruction

FIG. 11. Cooperation with Public Schools in Nature Study teaching. Miss Shaw, curator of elementary instruction, teaching five classes (250 pupils at P. S. 48, Brooklyn. The illustrative plant material was supplied by the Botanic Garden. (6053.)

REPORT OF THE CURATOR OF ELEMENTARY INSTRUCTION FOR 1926

DR. C. STUART GAGER, DIRECTOR.

Sir: I hereby present to you the fourteenth annual report from the Department of Elementary Instruction.

During the year 1926 this Department came into educational contact, through its various activities, with over 400,000 children; held 1,145 sessions of classes and lecture periods; placed 34,712 living plants in the schools; distributed 550,840 packets of seeds to school children; and supplied more nature material to the schools than in previous years. These are the high spots statistically in our work with the schools.

A number of requests have come to us this year for assistance in starting children's garden work in other places. In May, lessons in our methods were given to a representative of Madame Vitelli's Industrial School in Torre del Greco, Italy. The Brooklyn Botanic Garden donated American seeds for this little garden.

The Department helped start a garden for children at the Brooklyn Home for Consumptives under the patronage of the Brooklyn Branch of the National Plant, Flower and Fruit Guild. This work was continued throughout part of the summer. Our plans for children's gardening were sent by request to the Practice School in Sydney, Australia; School of Horticulture, Ambler, Pennsylvania; Board of Public Recreation, Stamford, Connecticut.

Some of the Curator's time during the spring and fall was used for lecture work in connection with our endowment campaign to bring it before the Mothers' Clubs and schools of our borough. It might be of interest to state here that the children of our own garden made the first contribution to this fund, and that the largest contribution from any one organization was made by the Garden Teachers' Association. Former students of the children's department met at the laboratory building in November and formed a temporary organization to facilitate the raising of their contribution to the fund.

The children's outdoor garden progressed along its regular lines. A list of plants in the Shakespeare Garden was published

prior to the annual Spring Inspection for distribution at that time. Sixty different schools were represented in the 1926 outdoor garden with a registration of 244. The planted area of the garden is approximately one-third of an acre. No crop report has been printed for some years so it seems pertinent to present the 1926 crop report as follows:

Beans	480	lbs.	Lettuce	4,945	heads
Beets	7,186		Onions	9½	lbs.
Beet tops	82	lbs.	Parsley	286	bunches
Carrots	10,248		Radishes	13,719	
Celery	87	bunches	Spinach	59½	lbs.
Chard	1,477½	lbs.	Tomatoes	443½	lbs.
Corn	695	ears	Turnips	219	
Kohlrabi	3,195				

October 22 a harvest exhibit of our children's garden produce was set up at the Eagle Building in their children's room.

Sponsored by the Women's Auxiliary, this Department set up an exhibit at the annual Exposition of Women's Work held in the Hotel Astor, October 4–9. It received wide publicity, and many requests for information came to us even from as far south as New Orleans. This was one of the most successful events of the year.

The Assistant Curator gave tests to 358 Girl Scouts who represented 50 Brooklyn troops; instruction was given to 146 scouts.

Saturday classes for children have been conducted as usual; the scope of this work, in some of its special aspects, has never been presented in any annual report. A series of special study topics follows:

A trip around the economic greenhouse
The Shakespeare Garden
The American Indian Garden:
Indians and their gardens
Planting the garden
Care of the garden
The crop
A visit to the Museum of the American Indian
Evergreens

The range of interests represented in these topics gives some idea of what is being done with our older boys and girls. On the Saturday when these particular topics were given by the children, we were visited by students from the National Recreational School, New York City. This group was studying methods of instruction in Saturday leisure-time work with children.

Public School 48, Brooklyn (Mr. Paul Kennedy, Principal, Miss Katharine Redden, Head of Department), solicited our help with an educational problem as follows: 250 fifth year children representing five classes and five teachers assembled for fifty minutes in the school auditorium to receive instruction in nature study (Fig. 000). The Curator, or an assistant, went each week from October to December—nine times in all. The real value of the work was demonstrated through the fact that this group was welded into a solid unit of interest, that the children themselves became an active, contributing part and not a passive, receiving body. It should be stated that the school authorities and the teachers were a background of enthusiastic support.

Miss Kathryn P. Clark, A.B. (Vassar College), was appointed instructor beginning September 15, 1926, in place of Mrs. Maude Hickok Free resigning at that time.

Personal Activities

I continue to act as National Secretary of the National Plant, Flower and Fruit Guild. I was appointed in December to the Council of the Brooklyn Girl Scouts.

Respectfully submitted,

ELLEN EDDY SHAW,
Curator of Elementary Instruction

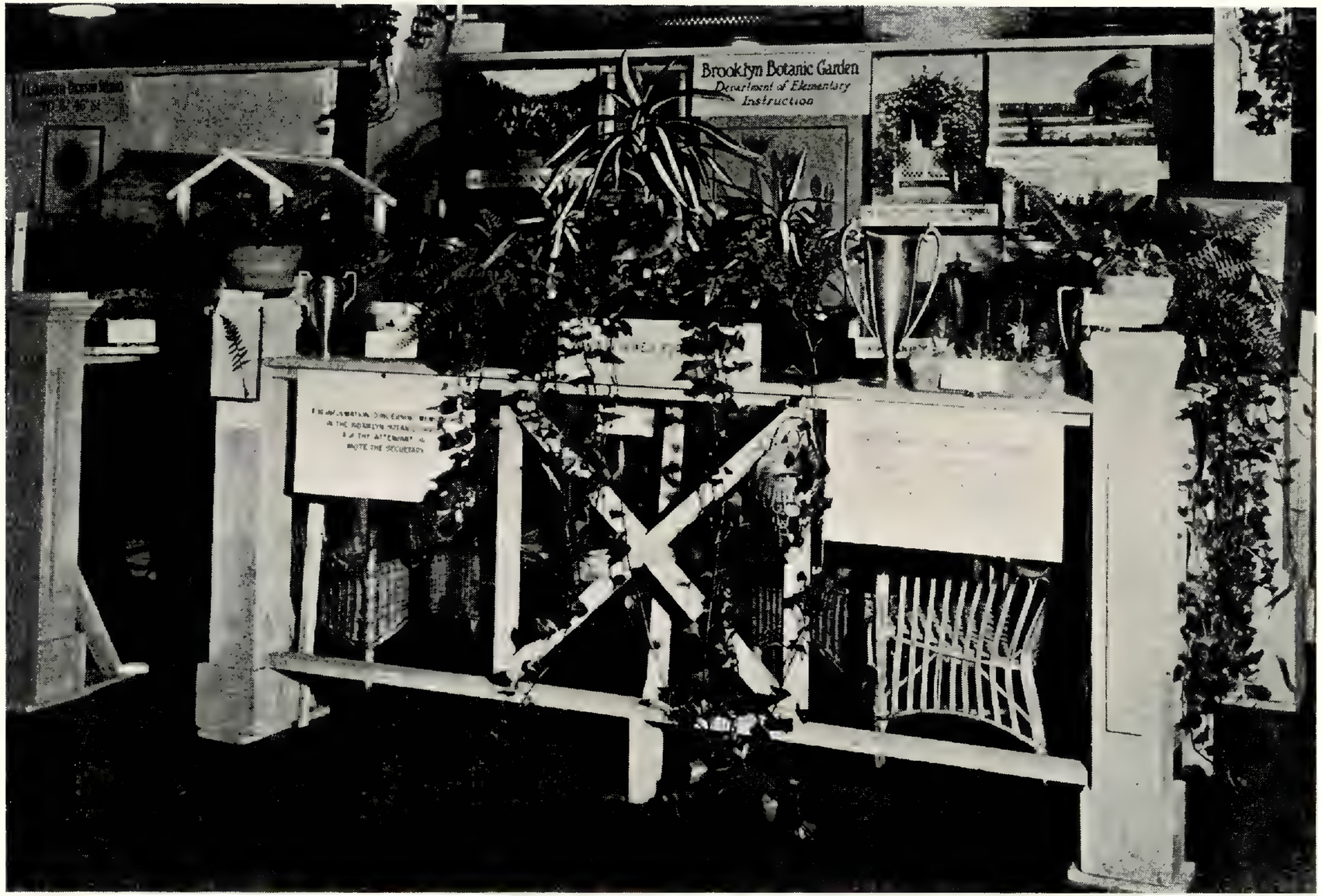

FIG. 12. Exhibit of Brooklyn Botanic Garden at the Exposition of Women's Work, Hotel Astor, October 4–9, 1926. (5989.)

REPORT OF THE LIBRARIAN FOR 1926

DR. C. STUART GAGER, DIRECTOR.

Sir: I have the honor to submit herewith my report as librarian for the year ending December 31, 1926.

The past year has shown definite progress. The total number of titles in the current serial and periodical file is now 847, an increase of 103 titles added during the year. 890 volumes and pamphlets have been added, making the total of volumes and pamphlets in the library 19,347.

Accessions

The 273 volumes received during the year through exchange, gift or purchase represent, in the main, individual titles rather than volumes belonging to sets of serials or periodicals. Among the more important book titles secured are, Buller's Researches on Fungi; Correns' Gesammelte Abhandlungen . . . 1899–1924; Crisp's Mediaeval Gardens; Dallimore & Jackson's Handbook of Coniferae; Johannsen's Elemente der Exakten Erblichkeitslehre; Kostytschew's Lehrbuch der Pflanzenphysiologie; Morgan's Genetics of Drosophila; several volumes of the new edition of the Natürlichen Pflanzenfamilien; Pearson's Life, Letters and Labours of Francis Galton; the Catalogue of Printed Books on Agriculture, 1471–1840, published by the Rothamsted Experimental Station; Shelford's The Naturalist's Guide to the Americas.

Through the generosity of Miss Harriet H. White the library has received the two volumes that have been published of Mary Vaux Walcott's American Wild Flowers and will receive, as published, later volumes. The library has also been presented, by the Hon. Richard Young, of Brooklyn, with the Park Commissioner's report for 1902, which includes historical data relating to the Garden.

The Pre-Linnean collection has been considerably augmented with titles from the 16th, 17th, and 18th century presses. These were purchased with the aid of the Gager Fund, specially set aside for the purchase of rare books. Among the titles thus acquired are, the Ortus Sanitatis, oder Gart der Gesuntheit . . .

printed at Strassburg in 1529; Dioscorides' De Medicinali Materia Libri Sex . . . Lyons, 1550; De Historia Stirpium Commentarii . . . by Fuchs, 1551; Les Observations de Plusieurs Singularitez . . . by Belon Du Mans, 1555; Matthioli's Senensis Medici Commentarii . . . Venice, 1565; Dodoens' Frumentorum Leguminum Palustrium et Aquatilium Herbarum . . . 1566; De Lobel's Plantarum Seu Stirpium Historia . . . 1576; Stirpium Historiae Pemptades Sex . . . by Remberti Dodoens, 1583; John Gerarde's The Herball, or Generall Historie of Plantes . . . 1st edition, 1597.

Tobias Aldinus' Exactissima Descriptio Rariorum Quarundam Plantarum . . . 1625; The Ortus Medicinae . . . by Van Helmont, 1655; Robert Boyle's Some Considerations Touching the Usefulnesse of Experimental Naturall Philosophy, 1st edition, 1663; John Evelyn's A Philosophical Discourse of the Earth, 1st edition, 1676; Robert Morison's Hortus Regius Blesensis . . . 1669; Matthiolis' Opera Omnia . . . 1674.

Leeuwenhoek's Regiae, Quae Londini Est, Societatis Collegae Epistolae Physiologicae . . . 1719; Francesco Redi's Opere . . . published in Venice, 1742–60; Linné's Flora Zeylanica . . . 1st edition, 1747, his Hortus Upsaliensis . . . 1st edition, 1748, and Species Plantarum . . . 1797–1805; Parmentier's Traité Sur la Culture et les Usages des Pommes de Terre, 1st edition, 1789.

Three titles were added to the Boys' and Girls' Club Room Collection which now numbers 162 volumes.

There are approximately 1,502 volumes in the Overflow Collection, shelved in the lower stackroom.

Periodicals, Serials, Documents

The more important titles added to the current file of serials and periodicals are, the Journal of the Royal Society of Western Australia; various titles issued by the Biologische Reichsanstalt für Land- und Forstwirtschaft, Berlin-Dahlem; Biologia Generalis; Botanikai Közlemények; Bothalia; Papers from the Botany School of Cambridge; Empire Cotton Growing Review; Schriften, Tartu (Dorpat) University, Esthonia; Folio Cryptogamica; Acta of the Horti Botanici of the Latviensis Universitatis; The Museum, Newark, N. J., North Western Naturalist; Plant Physiology; Polish Society of Naturalists "Kopernik"; Quarterly Re-

view of Biology; the Anales of the Sociedad Científica Argentina; Acta Botanica Fennica, and Meddelanden, of the Societas Pro Fauna et Flora Fennica; Memoirs of the Botanical Survey of South Africa; Stain Technology; Studies, Tokugawa Institute for Biological Research; Bulletin and Scientific Contributions from the Tropical Plant Research Foundation, and Bulletin and Transactions from the Wagner Free Institute of Science.

Binding

Over two hundred volumes have been forwarded for binding, mainly completed volumes of periodicals and serials. We hope to forward titles from the book collection, as well as periodical and serial titles during 1927.

Inter-Library Loans

Twenty-six volumes were borrowed for the staff from the Brooklyn Museum Library, Brooklyn Public Library, Cornell University Medical Library, Kings County Medical Library, New York Municipal Reference Library, New York Public Library, and the Library of the U. S. Department of Agriculture.

Thirty-seven publications were loaned during the year to the Biological Station, Cold Spring Harbor; Brooklyn Museum Library; Carnegie Institution of Washington, Department of Genetics, Cold Spring Harbor; Columbia University; Connecticut (Storrs) Agricultural Experiment Station; New York Municipal Reference Library; Rockefeller Institute, New York; Toronto University; and Union College of Schenectady, New York.

Reference Work

Our work in the library is thought of as primarily concerned with the staff, or with students, and yet we can trace a direct bearing of the Garden library on the economic life of our commercial community. As it happens, the firms asking for help this year were all located in Manhattan, with the exception of one publishing house of Yonkers, N. Y. Requests for assistance were received from a number of advertising firms, a life insurance company, several publishing houses, book shops, a chemical corporation, and a firm of patent lawyers.

Among individuals who received our assistance, we might mention specifically a physician who spent whole days in the library collecting data on plants that produce pollen effective in the cure of hay-fever; a horticulturist who intends introducing the mangosteen into Florida; a high school teacher preparing for his examination as head of a department of biology. Special lists of books and journals were forwarded, in reply to requests, to horticultural societies, as well as to individuals, not only in our vicinity, but to societies and persons of other cities.

The checking of the "Union List of Serials in the libraries of the United States and Canada," in order to include our holdings of serial and periodical titles, has been one of the important tasks of the year for the librarian. The list will be an invaluable tool when completed, for bibliographical information, for locating a volume one wishes to borrow, in completing broken sets, and for exchange purposes. While it has taken time, we feel it was time well spent in a co-operative library undertaking, which will result in knowing definitely where serial and periodical titles are to be located, and, in some cases, do away with unnecessary duplication of sets in the same locality.

Miscellaneous

The library was represented at the New York Library Association, at Lake Placid, where the librarian read a paper on Books and World Power; at the Eastern College Librarians' Meeting; the Special Library Association, and the New York Regional Catalogue Group. The librarian was made Chairman of the Committee for Special Libraries, of the New York Catalogue Group.

On September 23 and September 27, students from the Parson's School of Art, of Manhattan, under the direction of their teacher, worked in the library drawing from a collection of colored illustrations of flowers, and making original designs with the flowers as motives.

The Library School of the New York Public Library made its annual visit on May 21.

An exhibit of books was arranged in the library for the Contemporary Club for its meeting and tea of April 16th.

For list of donors and gifts, see Appendix 1.

The statistical report follows:

FIG. 13. Beehive demonstration at Brooklyn Botanic Garden before class from Girls' Commercial High School, Brooklyn, Sept. 28, 1926. Several such demonstrations were given during the year. (5984.)

STATISTICAL REPORT ON THE LIBRARY

Accessions

	Volumes	Pamphlets	Parts (Including Periodicals)
Exchange	68	228	4,223
Gift	45	241	1,325
Publication	0	148	366
Purchase	133	0	694
Bindery	27	0	0
Deposit	0	0	7
Total	273	617	6,615

Total number of parts of publications added to library during 1926, including current periodicals	6,615
Total number of volumes in library, December 31, 1925	10,779
Number of volumes added during 1926	273
Total number of volumes in library, December 31, 1926	11,052
Total number of pamphlets in library, December 31, 1925	7,678
Number of pamphlets added during 1926	617
Total number of pamphlets in library, December 31, 1926	8,295
Total number of volumes and pamphlets in library, December 31, 1925	18,457
Number of volumes and pamphlets added during 1926	890
Total number of volumes and pamphlets in library, December 31, 1926	19,347

Serials, Periodicals, and Documents

No title has been included in this list unless a number has been received during 1926.

Subscription	83
Gift	74
Exchange	678
Deposit from Brooklyn Public Library	2
Publication	10
Total	847

Cataloguing

Books, Pamphlets, and Serials catalogued	1,517
Total catalogue cards typewritten and filed	2,485
Torrey Botanical Club index cards on file, December 31, 1925	34,670
Filed during 1926	910
Total number of Torrey Botanical Club index cards on file, December 31, 1926	35,580
Index Algarum Universalis cards, December 31, 1925	19,519
Received during 1926	3,000
Total, December 31, 1926	22,519

Miscellaneous

Attendance in library	7,145
Books loaned to members of staff	1,301
Books loaned to other institutions	37
Books borrowed from other institutions	26

Respectfully submitted,

RAY SIMPSON,
Librarian

FINANCIAL STATEMENT FOR 1926

I. Tax Budget Accounts

1360 *Personal Service:*

Appropriation	$70,761.00
Expended	70,761.00

1361 *Other Codes than Personal Service:*

Line 1 Fuel Supplies:

Appropriation	$ 4,500.00
Expended	4,500.00

Line 2 Office Supplies:

Appropriation	$ 400.00
Expended	400.00

Line 3 Laundry, Cleaning and Disinfecting Supplies:

Appropriation	$ 40.00	
Transferred from Code 3039	30.00	$ 70.00
Expended		70.00

Line 4	Botanical and Agricultural Supplies:			
	Appropriation		$ 1,000.00	
	Transferred from Code 3039		500.00	$ 1,500.00
	Expended		$ 1,499.85	
	Transferred to Code 1361, Line 14, Telephone Service		.15	1,500.00
Line 5	General Plant Supplies:			
	Appropriation	$ 250.00		
	Transferred from Code 3039	150.00		
	Transferred from Code 1361, Line 9, General Plant Materials	2.31		
	Transferred from Code 1361, Line 10, Repairs and Replacements	71.28		
	Transferred from Code 1361, Line 11, Light, Heat and Power	198.92	$ 672.51	
	Expended			672.51
Line 6	Wearing Apparel:			
	Appropriation		$ 40.00	
	Expended			40.00
Line 7	Office Equipment:			
	Appropriation		$ 200.00	
	Expended			200.00
Line 8	General Plant Equipment:			
	Appropriation	$ 1,200.00		
	Transferred from Code 1361, Line 11, Light, Heat and Power	4.33	$ 1,204.33	
	Expended			1,204.33
Line 9	General Plant Materials:			
	Appropriation	$ 1,500.00		
	Transferred from Code 3039	150.00	$ 1,650.00	
	Expended	$ 1,647.69		
	Transferred to Code 1361, Line 5, General Plant Supplies	2.31	1,650.00	
Line 10	Repairs and Replacements:			
	Appropriation	$ 2,500.00		
	Transferred from Code 3510	1,973.00	$ 4,473.00	

	Expended	$ 4,401.72	
	Transferred to Code 1361, Line 5, General Plant Supplies	71.28	4,473.00
Line 11	Light, Heat and Power:		
	Appropriation		$ 500.00
	Expended	$ 288.30	
	Transferred to Code 1361, Line 5, General Plant Supplies	198.92	
	Transferred to Code 1361, Line 8, General Plant Equipment	4.33	
	Transferred to Code 1361, Line 13, Hire of Horses and Vehicles with Drivers	1.50	
	Transferred to Code 1361, Line 14, Telephone Service	6.95	500.00
Line 12	General Plant Service:		
	Appropriation		$ 500.00
	Expended		500.00
Line 13	Hire of Horses and Vehicles with Drivers:		
	Appropriation	$ 500.00	
	Transferred from Code 1361, Line 11, Light, Heat and Power	1.50	$ 501.50
	Expended		501.50
Line 14	Telephone Service:		
	Appropriation	$ 275.00	
	Transferred from Code 3039	70.00	
	Transferred from Code 1361, Line 4, Botanical and Agricultural Supplies	.15	
	Transferred from Code 1361, Line 11, Light, Heat and Power	6.95	
	Transferred from Code 1361, Line 16, Express and Deliveries	2.19	$ 354.29
	Expended		354.29
Line 15	Carfares:		
	Appropriation		$ 50.00
	Expended		50.00

Line 16 Express and Deliveries:			
Appropriation			$ 300.00
Expended		$ 297.81	
Transferred to Code 1361, Line 14, Telephone Service		2.19	300.00
Line 17 Contingencies:			
Appropriation			$ 100.00
Expended			100.00
Summary of Tax Budget Accounts:			
Appropriated		$84,616.00	
Transferred, June 17, 1926, from Miscellaneous, Kings County, Code 3510, Kings County Fund for Salary and Wage Accruals		1,973.00	
Transferred, December 2, 1926, from Miscellaneous, New York City, Code 3039, City Fund for Salary and Wage Accruals		900.00	$87,489.00
Expended			87,489.00

II. Private Funds Accounts

1. Endowment Fund ($50,500.00) Restricted in Part:			
Income Account:			
Income 1926			$ 2,777.48
Transferred to Endowment Increment Fund		$ 555.50	
Transferred to Special Contributions		2,221.98	2,777.48
			$ 0.00
2. Life Membership Fund ($5,500.00) Restricted:			
Income Account:			
Balance, January 1, 1926			$ 100.67
Income 1926			302.48
			$ 403.15
Expended		$ 106.00	
Transferred to Endowment Increment Fund		60.50	
Transferred to Annual Membership Account		236.65	403.15
			$ 0.00

3. George C. Brackett Library Fund ($500.00) Restricted:

Income Account:		
Balance, January 1, 1926		$ 1.90
Income 1926		27.48
		$ 29.38
Expended	$ 22.74	
Transferred to Endowment Increment Fund..	5.49	28.23
Balance, December 31, 1926		$ 1.15

4. Benjamin Stuart Gager Memorial Fund ($13,417.20) Restricted:

Income Account:		
Balance, January 1, 1926		$ 688.07
Income 1926		737.92
		$ 1,425.99
Expended	$ 620.69	
Transferred to Endowment Increment Fund..	147.58	768.27
Balance, December 31, 1926		$ 657.72

5. Martha Woodward Stutzer Memorial Fund ($10,000.00) Restricted:

Income Account:		
Balance, January 1, 1926		$ 220.00
Income 1926		275.00
		$ 495.00
Expended	$ 403.37	
Transferred to Endowment Increment Fund..	55.00	458.37
Balance, December 31, 1926		$ 36.63

6. Mary Bates Spalding Fund ($2,697.00) Restricted:

Income Account:		
Balance, January 1, 1926		$ 126.98
Income 1926		93.32
		$ 220.30
Expended	$ 160.91	
Transferred to Endowment Increment Fund..	18.66	179.57
Balance, December 31, 1926		$ 40.73

7. Special Account W. ($243,149.27) Restricted:

Income Account:		
Balance, January 1, 1926		$ 400.00
Income 1926		13,223.17
		$13,623.17
Expended	$ 235.25	
Transferred to Endowment Increment Fund..	2,564.63	
Transferred to Special Contributions	10,423.29	13,223.17
Balance, December 31, 1926		$ 400.00

8. A. Augustus Healy Bequest ($9,798.31) Restricted:

Income Account:		
Balance, January 1, 1926		$ .11
Income 1926		538.88
		$ 538.99
Transferred to Endowment Increment Fund..	$ 107.78	
Transferred to Special Contributions	431.21	538.99
		$ 0.00

9. Robert B. Woodward Bequest ($25,000.00) Restricted:

Income Account:		
Income 1926		$ 1,375.00
Transferred to Endowment Increment Fund..	$ 275.00	
Transferred to Special Contributions	1,100.00	1,375.00
		$ 0.00

10. A. T. White Memorial Tablet Fund ($3,889.85) Restricted:

Income Account:		
Balance, January 1, 1926		$ 58.23
Income 1926		213.92
		$ 272.15
Transferred to Endowment Increment Fund..	$ 42.78	
Transferred to Special Contributions	229.37	272.15
		$ 0.00

11. Brooklyn Institute Centennial Fund. B. B. G. Share. ($30,000.00) Restricted:

Income Account:		
Income 1926		$ 1,650.00
Transferred to Endowment Increment Fund..	$ 330.00	
Transferred to Special Contributions	1,320.00	1,650.00
		$ 0.00

12. John D. Rockefeller, Jr. Fund ($250,000.00) Restricted:

Income Account:		
Income 1926		$ 2,999.38
Expended	$ 577.85	
Transferred to Special Contributions	1,000.00	1,577.85
Balance, December 31, 1926		$ 1,421.53

13. Citizens Endowment Fund ($253,245.26) Restricted:

Income Account:		
Income 1926		$ 2,793.06
Expended	$ 227.85	
Transferred to Special Contributions	1,000.00	1,227.85
Balance, December 31, 1926		$ 1,565.21

14. Sustaining Membership. Restricted:

Balance, January 1, 1926		$ 163.30
Received from dues 1926		483.15
		$ 646.45
Transferred to Annual Membership Account		579.81
Balance, December 31, 1926		$ 66.64

15. Annual Membership. Restricted:

Received from dues 1926		$ 5,343.00
Transferred from Life Membership		236.65
Transferred from Sustaining Membership		579.81
		$ 6,159.46
Deficit, January 1, 1926	$ 1,825.67	
Expended	3,205.75	5,031.42
Balance, December 31, 1926		$ 1,128.04

16. Tuition and Sales. Restricted:

Balance, January 1, 1926		$ 46.32
Received 1926:		
a. Tuition	$ 1,590.01	
b. Seed Packets	5,631.47	
c. Sales	66.74	7,288.22
		$ 7,334.54
Expended	$ 5,038.13	
Transferred to Endowment Increment Fund	1,122.77	6,160.90
Balance, December 31, 1926		$ 1,173.64

17. Botanic Garden Collections Fund, 1926. Restricted:			
Balance, January 1, 1926			$ 22.27
Received from Contributors			6,980.28
Transferred from Special Purposes			1.18
			$ 7,003.73
Expended		$ 4,674.90	
Transferred to Special Contributions		2,051.46	6,726.36
Balance, December 31, 1926			$ 277.37
18. Special Fund (Brooklyn Institute General Endowment Income: Annual Allotment) Restricted:			
Income Account:			
Income 1926			$ 2,200.00
Transferred to Special Contributions			2,200.00
			$ 0.00
19. Cary Library Fund ($10,000.00—1/5 of Income to Brooklyn Botanic Garden) Restricted:			
Balance, January 1, 1926			$ .69
Income Allotment 1926			110.00
			$ 110.69
Expended		$ 86.83	
Transferred to Endowment Increment Fund		22.00	108.83
Balance, December 31, 1926			$ 1.86
20. Special Purposes. Restricted by terms of gifts:			
Balance, January 1, 1926			$ 1,656.97
Received:			
a. Anonymous for Japanese Garden	$ 500.00		
b. Various for Test Garden for Japanese Iris	305.98		
c. Anonymous Special Gift for Children's Work	165.00		
d. Anonymous (through Mrs. Glentworth R. Butler)	25.00		
e. Mrs. John R. Delafield for Lantern Slides	25.00		
f. Mrs. E. Root for contribution to Conservation of Beauty Leaflet	1.00		
g. Mrs. H. F. Kean for Fern Distribution	10.00	1,031.98	
			$ 2,688.95
Expended		$ 1,584.09	

Transferred to Special Contributions (with consent of donor)	250.00	
Transferred to Collections Fund (with consent of donor)	1.18	1,835.27
Balance, December 31, 1926		$ 853.68

21. Plant Pathology Research Fund. Restricted:

Balance, January 1, 1926	$ 3,423.54
Income 1926	7,500.00
	$10,923.54
Expended	8,331.61
Balance, December 31, 1926	$ 2,591.93

22. Special Contributions (for 1926 only):

Contributed	$ 508.19
Transferred from Endowment Fund Income Account	2,221.98
Transferred from Special Account W. Income Account	10,423.29
Transferred from A. Augustus Healy Bequest Income Account	431.21
Transferred from R. B. Woodward Bequest Income Account	1,100.00
Transferred from A. T. White Memorial Tablet Fund Income Account	229.37
Transferred from Brooklyn Institute Centennial Fund Income Account	1,320.00
Transferred from J. D. Rockefeller, Jr. Fund Income Account	1,000.00
Transferred from Citizens Endowment Fund Income Account	1,000.00
Transferred from Collections Fund	2,051.46
Transferred from Special Fund (Inst. General Endow.)	2,200.00
Transferred from Special Purposes	250.00
	$22,735.50
Deficit, January 1, 1926	$ 2,245.21
Expended	20,064.74
Balance, December 31, 1926	$ 425.55

23. Endowment Increment Fund ($32,972.94) Restricted:

Transferred from other accounts 1926	$ 5,307.69
Interest 1926	1,502.83
	$ 6,810.52
Transferred to Principal	6,810.52
	$ 0.00

Summary of Private Funds Accounts:

Balances, January 1, 1926		$ 6,909.05
Income 1926		59,269.55
		$66,178.60
Expended	$50,229.23	
Transferred to Endowment Increment Fund Principal	5,307.69	55,536.92
Balances, December 31, 1926		$10,641.68

III. Summary of Total Maintenance Budget for 1926

Income		
Tax Budget Appropriation (57%)	$87,489.00	
Private Funds Budget (43%)	66,178.60	
Total		$153,667.60
Transferred to Endowment Increment Fund Principal		5,307.69
Available		$148,359.91
Expended		
Personal Service		
Tax Budget	$70,761.00	
Private Funds	22,309.95	
Total	$93,070.95	
Other than Personal Service		
Tax Budget	$16,728.00	
Private Funds	27,919.28	
Total	$44,647.28	
		$137,718.23
Balance, December 31, 1926		$ 10,641.68

Respectfully submitted,

DANIEL C. DOWNS,
Secretary and Accountant

Note:—The above "Financial Statement" is a transcript of Brooklyn Botanic Garden accounts in the books of the Treasurer of the Brooklyn Institute of Arts and Sciences. The Treasurer's accounts are audited annually by a Public Accountant, and a

separate audit of this "Financial Statement" is not made in order to save unnecessary expense.

G. FOSTER SMITH,
Treasurer

IV. For Permanent Improvements

Appropriation of Revenue Bonds of the City of New York for Permanent Improvements, and Expenditures therefrom during 1925 and 1926.

R. D. P. 216-B, for Furnishing and Erecting Wrought Iron Picket Fence around Brooklyn Botanic Garden.

Appropriated		$40,000.00
Expended		
Independent Wire Works, Amount of Contract	$34,440.00	
Independent Wire Works, Paid in excess of Contract	1,057.67	
Independent Wire Works, Turnstiles	810.00	
Independent Wire Works, Gate Guards	400.00	
Paul J. Hand, Resetting Steps	750.00	
Engineer's Payroll (Department of Parks)	1,199.41	
E. G. Soltmann (Specifications and Prints)	25.50	38,682.58
Balance, December 31, 1926		$ 1,317.42

Time limit for expenditure of Bond expired December 31, 1926.
Balance automatically rescinded by the Comptroller.

Approved as correct,
EDWARD S. RYAN, *Chief Clerk,*
Department of Parks, Borough of Brooklyn

APPENDIX 1

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" " P. S. 180
" " P. S. 185
" " P. S. 193
" " P. S. 199
" " P. S. 201
" " P. S. 217
" " P. S. 221

Parents' Association, P. S. 109
" " P. S. 173
" " P. S. 177

Public School No. 2, Teachers
" " " 18, Principal and Teachers
" " " 24, Principal and Teachers
" " " 41, Principal, Teachers and Pupils
" " " 55, Teachers
" " " 62
" " " 87, Pupils
" " " 106
" " " 129, Principal and Teachers
" " " 165, Teachers
" " " 167, Nature Club of Pupils
" " " 182, Nature Club of Teachers and Pupils
" " " 183, Teachers
" " " 185, Teachers and Pupils
" " " 199, Pupils

Schmalzer, Mrs. Anna B.
Schretzlmeir, E.
Schumann, Carl J.
Scott, B. A.
Seaman, Miss Mary T.
Shaw, Aubret N.
Shaw, Harry B.
Shaw, Robert Alfred
Shea, Mr. and Mrs. J. L.
Shepard, Miss Anna U.

Shepard, Charles S.
Shepard, Miss Margaret J.
Shepherd, Miss L. L.
Simon, A. H.
Simpson, Miss Mabel
Smith, George William
Smith, G. Foster
Smith, Miss Helen T.
Smith, Herbert S.
Smith, Mrs. Hugh M.
Smith, James A.
Smith, Mrs. John W.
Smith, Leonard Hull
Smith, Miss M. Helen
Smith, Miss Olive K.
Smythe, Benjamin E.
Somers, Mrs. Daniel McL.
Somers, Harold
Sonfield, Chas.
Southwell, Miss E. E.
Sperry, Elmer A.
Spier, Mrs. Jesse
Spring, Miss Louise M.
Squibb, Dr. Edward H.
Squires, Miss Laura
Stacey, Mr. and Mrs. Sidney G.
Steinbrink, Meier
Steinbrucker, Charles
Stellwagen, Fred L.
Sterling, Miss Edith M.
Sternberger, Louis
Stevenson, Miss Ivy
Stewart, Miss Elsie R.
Stewart, Miss Madeline
Stewart, Mrs. John Wood
Stewart, Mrs. Seth Thayer
Stockwell, Miss Bertha
Stoughton, Miss Elizabeth C.
Straus, Hugh Grant
Stutzer, Miss Elise W.
Stutzer, Herman
Sullivan, Andrew T.
Sullivan, Miss Bessie
Summers, Miss Doris
Swahn, Mrs. Fanny D.

Taylor, Wm. M.
Taylor, Miss Venetia
Thayer, Mrs. J. Van Buren
Thirkield, Gilbert H.
Thommen, Dr. August A.
Thorn, Miss Mathilda E.
Tisch, Charles
Tischemacher, Miss H. A.
Tompkins, Miss Elizabeth M.
Towne, Benjamin
Tredick, Miss Helen F.
Trost, Mrs. Julia T.
Trostler, Mrs. Emil
Tumbridge, Mrs. Stanley S.
Tuttle, Winthrop M.
Twitchell, Herbert K.
Twomey, Miss Gertrude R.
Two Students of Miss Shaw's
Tyler, Mrs. Walter L.

Uhrbrock, Harold
Uhrbrock, Mrs. E. F.
Underwood, John T.
Urban Club

Van Brunt, Jeremiah R.
Vanderveer, Henry B.
Van Nostrand, Mrs. B. T.
Van Sinderen, Mrs. Adrian
Van Vleck, The Misses
Volhard, Miss Amelia A.
Von Campe, Mr. and Mrs. Edw.
Von Lehn, Richard, Jr.

Walsh, Miss Elizabeth J.
Walter, Miss Cora B.
Wardell, Mrs. T. W.
Ward, Mrs. Edwin C.
Warfield, Harry E.
Warner, Mr. and Mrs. Edwin G.
Warner, Miss Ethel J.
Warner, Walter E.
Warren, Miss Eliza H.
Warren, Mr. and Mrs. Walter H.
Waterman, Miss Maud L.
Wayman, Miss Grace L.

Weber, Richard E.
Weber, Robert
Weck, Mrs. Edward
Weekes, Miss Ethel A.
Wells, Mrs. Walter F.
Westbrook, Dr. & Mrs. Richard W.
White, Alexander M.
White, Harold T.
White, Miss Harriet H.
White, Mrs. William Augustus
Wieman, Miss Josephine M.
Wiley, Miss F. A.
Williams, R. L.
Wilmarth, Miss Mabel
Wilson, Edith M.
Wilson, W. O.
Wing, Beulah A.
Winkler, Harry
Winter, Thos. W., Jr.
Wintringham, William T.
Woodward, Miss Mary B.
Worthington, Miss Charlotte
Young, Miss A.
Young, Richard
Zabriske, Mrs. Cornelius
Zimmele, Chas. F.
Zimmer, Wilson B.
Zundel, Robert W.

APPENDIX 2

GIFTS RECEIVED DURING 1926

Collection Fund

Mrs. John R. Delafield
Mrs. W. D. Spalding
Mrs. J. H. Post
Frank Bailey
Miss C. Julie Husson
Miss Harriet H. White
Miss Frances E. White
Frank L. Babbott
Girl Scouts through Mrs. G. H. Tomes for Memorial Tree
Miss Hilda Loines
George D. Pratt
Otto Ebel
Mrs. Wm. E. Harman

Living Plants

American Rose Society, 2 Roses.
Mrs. E. G. Birdsall, 10 *Sarracenia purpurea.*
Mrs. J. Bramin, 1 *Iris.*
Bureau of Plant Industry, 25 *Amaryllis.*
W. Atlee Burpee Co., 12 varieties of *Iris.*
Miss Edna Carpenter, 1 *Tillandsia usenoides.*
Prof. W. P. Cottany, 1 *Azolla caroliniana.*
Mrs. J. R. Delafield, 1 *Acacia alta.*
Mr. Henry A. Dreer, 12 varieties of *Iris.*
Mr. H. Durand, 1 Fern.
Eastern Nurseries, *Helwingia japonica,* forms of *Calluna,* and herbaceous plants.
Mr. Fellowes, 2 *Prunella.*

Mr. Edwin Gould, 1 *Cycas revoluta.*
Mr. Theo. J. Graebner, 1 *Polypodium,* 1 *Phegopteris.*
Prof. H. M. Hall, 1 *Frankenia grandifolia.*
Mrs. George H. Harman, 6 Rattlesnake Plantain.
Mr. L. W. Hitchcock, 1 *Iris.*
Mr. C. W. Johnson, 2 *Polygala.*
Mr. G. E. Nichols, 6 Clumps *Iris lacustris,* 12 *Anemone multifida.*
Mrs. E. A. S. Peckham, 1 Bearded Iris, Princess Beatrice.
Mr. Edward M. Powers, 1 *Aloe,* 1 *Sedum.*
Miss Grace Sturtevant, 1 *Iris.*
Miss Venetia Taylor, 1 *Linaria canadensis,* 3 *Arisaema triphyllum.*
Miss Maude E. Voris, 1 *Lilium elegans.*
Mr. Robert Wayman, 257 plants of 160 varieties of tall bearded *Iris* (1925 and 1926).

Seeds

Dr. W. W. Ashe (1)
Mrs. George S. Brown (30)
Mrs. G. R. Butler (1)
Mr. L. Cantor (9)
Mr. Willard N. Clute (1)
Mrs. F. L. Dow (5)
Mr. Robert B. Job (1)
Mrs. C. S. Lewis (3)
Mr. A. L. Poessel (2)
Mr. R. Williams (7)

Phanerogamic Herbarium

Dr. Howard J. Banker,
148 pressed specimens from Florida.
Children's Museum, Brooklyn,
Various collections from New York, China, and Switzerland.
Miss Frances C. Fisbeck,
145 specimens collected near Williamstown, Mass.
Mr. Frank H. Henry,
1 Redwood burr.
Mr. E. S. Miller,
345 specimens from Wading River, N. Y.
Miss B. Underwood,
53 pressed flowers, moss, and seaweed from Alaska.
Miss Ethel V. Woodward,
4 specimens from Los Angeles, California.

Cryptogamic Herbarium

No accessions by gift received during 1926.

Iris Project

Special Fund

Robert Wayman	$ 20.00
Harlan P. Kelsey	5.00
Stumpp and Walter Company	25.00
American Iris Society	100.00
H. T. du Pont	20.00
Mrs. Wheeler H. Peckham	60.98
L. G. Tiffany	75.00
	$305.98

Plants

Gifts of plants for the Iris Project are listed on page 000.

Library

(Exclusive of U. S. Government Documents)

BOOKS

Carnegie Institution of Washington, Washington, D. C.	2
Mrs. John Ross Delafield, 17 E. 79th Street, New York, N. Y.	1
Fairchild Sons, Inc., Brooklyn, N. Y.	1
Mrs. Maude Hickok Free, Brooklyn, N. Y.	1
Mr. Montague Free, Brooklyn, N. Y.	1
Dr. C. Stuart Gager, Brooklyn, N. Y.	13
Dr. A. H. Graves, Brooklyn, N. Y.	1
Dr. Fortunato L. Herrera, Cuzco, Peru	1
Dr. S. Nawashin, Kiev, Russia	1
Miss Maud E. Purdy, Brooklyn, N. Y.	1
Miss Ellen Eddy Shaw, Brooklyn, N. Y.	1
Miss Ray Simpson, Brooklyn, N. Y.	1
Mr. Norman Taylor, Brooklyn, N. Y.	2
Miss Caroline E. Ward, 415 Beacon Street, Boston, Mass.	12
Miss Harriet H. White, Brooklyn, N. Y.	2
Dr. O. E. White, Brooklyn, N. Y.	1
Woodcraft League of America, Mogewetu Tribe of Brooklyn	1
Hon. Richard Young, 87 Lincoln Road, Brooklyn, N. Y.	1
Total	44

PAMPHLETS

Mr. Robert W. Ascroft, East Molesey, Surrey, England	1
Dr. Harry S. Bernton, Georgetown University, Washington, D. C.	2
Dr. J. W. Bews, Armstrong College, Newcastle-upon-Tyne, England	11

Prof. N. Borodin, Brooklyn Museum, Brooklyn, N. Y.	1
Prof. F. O. Bower, University of Glasgow, Glasgow, Scotland	9
Brooklyn Museum Library, Brooklyn, N. Y.	4
Carnegie Institution of Washington, Department of Genetics, Cold Spring Harbor, Long Island	7
Carnegie Institution of Washington, Washington, D. C.	15
Prof. Henry H. Dixon, School of Botany, Trinity College, Dublin, Ireland	24
Dr. O. A. Farwell, Detroit, Michigan	1
Mr. Charles Frankenberger, 1313 Bedford Avenue, Brooklyn, N. Y.	1
Mr. Montague Free, Brooklyn, N. Y.	2
Dr. C. Stuart Gager, Brooklyn, N. Y.	97
Dr. A. Gundersen, Brooklyn, N. Y.	4
Dr. R. T. Gunther, Oxford, England	1
Horticultural Society of New York, 598 Madison Avenue, N. Y. C.	14
Dr. Charles Janet, Paris, France	1
Dr. Aniela Kozlowska, Krakow, Poland	1
Dr. Beatrice Lee, Botany Department, University of Leeds, Leeds, England	2
McGill University, Department of Botany, Montreal, Canada	4
Dr. Koki Masui, College of Science, Kyoto Imperial University, Kyoto, Japan	2
Moscow Société des Amis des Sciences Naturelles, d'Anthropologie et d'Ethnographie	2
National Research Council, Washington, D. C.	1
Dr. M. Nawashin, Kiev, Russia	1
Dr. S. Nawashin, Kiev, Russia	2
Dr. Alvar Palmgren, Andregatan, 19, Helsingfors, Finland	2
Dr. J. H. Priestley, Botany Department, University of Leeds, Leeds, England	1
Dr. Francis Ramalay, Boulder, Colorado	1
Dr. Lucien Reychler, Saint-Nicholas (Waes), Belgium	1
Dr. E. Rhodes, Botany Department, University of Leeds, Leeds, England	1
Mr. Lars-Gunnar Romell, Brahegatan 51, Stockholm, Sweden	2
Miss Ray Simpson, Brooklyn, N. Y.	2
Mr. Henry M. Steece, Department of Agriculture, Washington, D. C.	1
Dr. Dezydery Szymkiewicz, Warsaw, Poland	1
Mr. Norman Taylor, Brooklyn, N. Y.	18
Wild Flower Preservation Society, Washington, D. C.	1
Total	241

PARTS OF PUBLICATIONS

American Railway Association, New York	1
Brooklyn Museum Library, Brooklyn, N. Y.	26

Canadian Arctic Expedition, Ottawa, Canada	7
Carnegie Institution of Washington, Washington, D. C.	4
City Gardens Club, New York	1
Colorado State Medical Society, Denver, Colorado	1
Mr. Montague Free, Brooklyn, N. Y.	9
Dr. C. Stuart Gager, Brooklyn, N. Y.	153
Garden Club of America, New York City	12
Dr. Arthur H. Graves, Brooklyn, N. Y.	6
Mrs. Helen Smith Hill, Brooklyn, N. Y.	1
Horticultural Society of New York	2
Mrs. Clarence R. Hyde, 242 Henry Street, Brooklyn, N. Y.	12
National Plant, Flower and Fruit Guild, New York	1
New York Academy of Sciences, New York	28
New York Association of Biology Teachers, New York	2
New York City Department of Health	70
New York Public Library, Slavonic Division, New York	2
Miss Ann Ohlander, Brooklyn, N. Y.	1
Dr. W. A. Orton, Tropical Plant Research Foundation, Washington, D. C.	1
Pratt Institute Free Library, Brooklyn, N. Y.	1
Miss Helen F. Sanders, 454 7th Street, Brooklyn, N. Y.	2
Dr. C. S. Sargent, Jamaica Plain, Boston, Massachusetts	1
School Garden Association of New York	11
Miss Ellen Eddy Shaw, Brooklyn, N. Y.	1
Mrs. Annie Morrill Smith, Bronxville, N. Y.	6
Mr. Norman Taylor, Brooklyn, N. Y.	74
Dr. O. E. White, Brooklyn, N. Y.	3
Wild Flower Preservation Society, Cincinnati, Ohio	5
Woman's National Farm & Garden Association, New York	5
Total	449

PORTRAITS

Dr. C. Stuart Gager, Brooklyn, N. Y.	8
Dr. A. C. Seward, Downing College, Cambridge, England	2
Total	10

For the Department of Elementary Instruction

Boy Scout Troop No. 206, One bird house.

Butler, Mrs. Glentworth R., One prize cup to be competed for by the girls of the 1926 outdoor garden.

Delafield, Mrs. John R., $25 for the children's work.

Doll, Mr. Jacob, 80 specimens of moths and butterflies.

Driggs, Miss Alice, Flower books as prizes for excellent work in the children's outdoor garden.

Flatbush Garden League (through Mrs. E. L. Carson), Prize books on gardening to be competed for in the outdoor garden.

Garden Teachers' Association, One prize cup to be competed for by the boys of the outdoor garden.

Gunnison, Mr. and Mrs. Herbert F., $15 in memory of Dr. Glentworth R. Butler, for the children's library.

Hyde, Mrs. Clarence R., Cacao pods; twigs and leaves of tropical plants. Specimens for class room use.

Hyde, Mrs. Clarence R., Subscription to the Nature Magazine for the children's library.

Kline, Miss Isabell, A picture of Mrs. Glentworth R. Butler taken in the Holy Land.

Le Conte, Miss Caroline, Bulbs of Jonquils for the children's garden.

Oppenheim, Mrs. E. C., $10 for the children's library.

Post, Mrs. James H., $150 for the children's garden house.

Pratt, Mr. Abram, $5 for the children's room.

Purdy, Miss Maud H., One book for the children's library.

Shaw, Miss Ellen Eddy, One book for the children's library.

Shaw, Miss Ellen Eddy, Two gold honor pins for honorable service in the 1926 outdoor garden.

Simpson, Miss Ray, One book for the children's library.

White, Miss Harriet H., $25 for slides.

Woodward, Miss Ethel V., $5 for the children's room.

Spring Inspection

(Gifts from the Woman's Auxiliary and from individual members)

Mrs. John Hills, 1 Samovar tray.

Mrs. John E. Leech, 1 Samovar.

Mrs. Frank Lyman, 1 Samovar.

Miss Frances E. White, 1 Samovar, 1 Samovar tray, and 1,000 Sandwiches.

Anonymous (several donors):

1 Samovar tray, 3 Old Russian basins, 2 Aluminum pitchers, 6 Large dinner trays, 6 Lemon forks, 24 dozen teaspoons, 6 Papier mache trays.

Total value of above gifts	$165.84
The Woman's Auxiliary (For expenses of the Inspection)	121.80
Total	$287.64

Miscellaneous

Anonymous.

$500 for the Japanese Garden.

Mr. William T. Davis.
Japanese Praying Mantis (*Paratenodera sinensis* Saussure). Mounted specimens (male and female) and egg-case.
Mrs. William Sterling Peters.
1 Bronze flower container.

APPENDIX 3

PUBLICATIONS OF MEMBERS OF STAFF DURING 1926

Benedict, Ralph C.

—— New plant conservation laws. *American Fern Journal* **16**: 59. April–June.
—— Saving the Hart's Tongue. *American Fern Journal* **16**: 33–44. April–June.

Free, Montague

—— *Clerodendron trichotomum*—Is It Hardy? *Florists Exchange* **63**: 917, 920. November.
—— Fifteenth Annual Report of the Brooklyn Botanic Garden. Report of the Horticulturist. *Brooklyn Bot. Gard. Rec.* **15**: 88–91. April.
—— House Plants. *Brooklyn Bot. Gard. Leaflets* **XIV**[1]. April 7.
—— "Naturalized" Bulbs. *Brooklyn Bot. Gard. Leaflets* **XIV**[2]. April 21.

Gager, C. Stuart

—— Fifteenth Annual Report of the Brooklyn Botanic Garden, 1925. Report of the Director. *Brooklyn Bot. Gard. Rec.* **15**: 23–55. April.
—— A laboratory guide for general botany. Third edition. Pp. x + 205. Philadelphia, P. Blakiston's Son & Co. July.
—— General botany: with special reference to its economic aspects. Pp. xvi + 1056. Philadelphia, P. Blakiston's Son & Co. September.

Graves, Arthur Harmount

—— The present continued development of basal shoots from blighted chestnut trees. *Science N.S.* **63:** 164–165. February 5.

—— An unusual insect gall on scarlet oak (*Quercus coccinea* Muench). *Torreya* **26:** 1–2. February.

—— Report of work in forest pathology for 1295. *Brooklyn Bot. Gard. Rec.* **15:** 58–60. April.

—— Report of the Curator of Public Instruction for 1925. *Brooklyn Bot. Gard. Rec.* **15:** 67–70. April.

—— The cause of the persistent development of basal shoots from blighted chestnut trees. *Phytopath.* **16:** 615–621. September.

—— Forms and functions of leaves. *Brooklyn Bot. Gard. Leaflets* **14**[9-10]: 1–8. November.

—— 72 newspaper articles relating to the Brooklyn Botanic Garden.

—— 3 abstracts of botanical books and papers in *Botanical Abstracts,* Vol. 14, and in *Biological Abstracts,* Vol. 1.

Gundersen, Alfred

—— Seed List. *Brooklyn Botanic Garden Rec.* **15:** January (with M. Free).

—— International Seed Exchange, Communication No. 7, May (with C. S. Gager).

—— The Classification of Dicotyledons. (Book Review.) *Torreya* **26:** 70–75. (July–August.)

—— The Need of an Enlarged List of Botanical Nomina Conservanda. *Science* **64:** 182–183. August.

Kiernan, Francis P., and Orland E. White

—— Color inheritance in four o'clocks. *Jour. Heredity* **17:** 383–386. October.

Peck, Mary Ellen

—— Twenty-seven abstracts of scientific papers relating to plant breeding, heredity, and evolution. *Botanical Abstracts* (Genetics Section). Vol. XV.

Shaw, Ellen Eddy

—— New Year's greetings. *Natl. Plant, Flower and Fruit Guild Mag.* **15**: 1. January.

—— All year round program for Guild workers. *Natl. Plant, Flower and Fruit Guild Mag.* **15**: 1. January.

—— A school of nuts—How cocoanuts are gathered. *Junior Home Mag.* **7**: 1. January.

—— Some requisites necessary for success in business life. Woman's Page, *Brooklyn Daily Eagle*. January.

—— The soil. *Natl. Plant, Flower and Fruit Guild Mag.* **15**: 2. March.

—— Report of the Curator of Elementary Instruction. *Brooklyn Bot. Gard. Rec.* **15**: 70–75. April.

—— The school garden in child life. *American Childhood* **11**: 8. April.

—— Garden clubs. *Natl. Plant, Flower and Fruit Guild Mag.* **15**: 5. May.

—— My skipping rope—The story of sisal and Manila fiber. *Junior Home Mag.* **7**: 5. May.

—— The chocolate tree's nurse—The story of the banana. *Junior Home Mag.* **7**: 7. July.

Simpson, Ray

—— Report of the Librarian for 1925. *Brooklyn Bot. Gard. Rec.* **15**: 76–80. April.

Taylor, Norman

—— Plant life on East Anglian heaths. *Ecology* **7**: 111. January.

—— Grier's Notes on the flora of Long Island. *Rhodora* **27**: 213–215. February.

—— The sun, the wind, and the gardener. *Garden Magazine* **42**: 426. February.

—— Mrs. Walcott's "North American Wild Flowers." *Saturday Review of Literature*. April.

—— Report of the Curator of Plants and Plantations for 1925. *Brooklyn Bot. Gard. Rec.* **15**: 81–83. April.

—— Notes on the plant life of the DuVal Trail from Brandon, Vermont, to the Long Trail on the Green Mountains. 1–8. Green Mountain Club. June.

—— 1925 supplement to author's Botany, the Science of Plant Life. P. F. Collier & Son. December.

White, Orland E.

—— Geographical distribution and the cold-resisting character of certain herbaceous perennial and woody plant groups. *Brooklyn Bot. Gard. Rec.* **15**: 1–10. January.

—— The Amazon valley. Pp. 674–681. In "The Naturalist's Guide to the Americas," published under the auspices of The Ecological Society of America by Williams & Wilkins Co., Baltimore. February.

—— Report of the Curator of Plant Breeding and Economic Plants for 1925. *Brooklyn Bot. Gard. Rec.* **15**: 87. April.

—— Environment, variation, and the laws of heredity. *Brooklyn Bot. Gard. Leaflets* **XIV**[3–6]. May.

—— The forests of the Rio Beni Basin of Bolivia. *Cornell Forester* **6**: 16–20. May.

—— Peas and people. *Brooklyn Bot. Gard. Rec.* **15**: 141–148. July.

—— Heredity and variation in plants. Three chapters, pp. 935–1000, in "General Botany" by C. Stuart Gager. P. Blakiston's Son & Co., Philadelphia. September.

—— The ways of plants. *Brooklyn Bot. Gard. Leaflets* **XIV**[7 8]. October.

—— The origin by mutation of differences in cold-resistance in the same plant species. (Abstract.) *Anatomical Rec.* **34**: 176. December.

—— Twelve abstracts of scientific papers and books relating to plant breeding, heredity, and evolution. *Botanical Abstracts* (Genetics Section). Vol. XV.

White, Orland E. and Dorothy I. Neff

—— The genetic analysis of peas (Pisum). Genetics and Plant Breeding. Reports on Research for 1925. *Brooklyn Bot. Gard. Rec.* **15**: 60–64. April.

APPENDIX 4

TALKS, PUBLIC LECTURES, ADDRESSES, AND PAPERS GIVEN BY MEMBERS OF STAFF DURING 1926

By the Director of the Garden:

April 15. *Address of Welcome,* to The Contemporary Club and Brooklyn Art League. Brooklyn Botanic Garden.

April 23. *The Conservation of Wild Flowers.* Assembly of Bay Ridge High School, Brooklyn.

April 27. *Brooklyn and the Brooklyn Botanic Garden.* Newspaper Men's Luncheon, Hamilton Club.

May 1. *The Importance of Trees.* Brooklyn Children's Museum. Exercises at the planting of two copper beeches in memory of Miss Margaret Wilson Carmichael and Miss Marguerite Mayer.

May 1. *New York's Biggest Flower Garden.* (The Brooklyn Botanic Garden.) Broadcast Talk, Station WNYC.

May 3. *Evolution Now and Then.* (The Recent Evolution Controversy: an Historical Comparison.) Winter's Night Club, Brooklyn Botanic Garden.

June 4. *What is a botanic garden?* Young People's League, Protestant Dutch Reformed Church, Flatbush.

November 13. *Conservation work of the Brooklyn Botanic Garden.* New York Bird and Tree Club, Hotel Roosevelt, New York City.

By the Curator of Elementary Instruction:

January 7. *Children's Work at the Brooklyn Botanic Garden.* St. Bartholomew's Community House.

April 26. *Little gardens.* P. S. No. 40, Queens.

May 4. *Value of nature study.* Talk to entering class, Maxwell Training School for Teachers.

May 18. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 89.

May 20. *Spring and little gardens.* Birch Wathen School, New York.

May 20. *Experiments in education at the Brooklyn Botanic Garden.* Brooklyn Kindergarten Association. At the Garden.

May 24. *The plant world.* Eastern District High School.

May 25. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 139. At the Garden.

May 25. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 217. At the Garden.

May 25. *What the plant world gives to us.* P. S. No. 183.

June 1. *The work of the Brooklyn Botanic Garden.* Lewis Avenue Church Auxiliary Meeting. At the Garden.

June 2. *The work of the Brooklyn Botanic Garden.* Mothers Club, P. S. No. 108. At the Garden.

June 4. *The work of the Brooklyn Botanic Garden.* Kindergarten Mothers' Club, P. S. No. 141. At the Garden.

June 12. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 57. At the Garden.

October 13. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 130. At the Garden.

October 13. *The work of the Brooklyn Botanic Garden.* Columbia Dames. At the Garden.

October 18. *Bulb culture.* P. S. No. 48.

October 25. *Fall coloration.* P. S. No. 48.

November 1. *Seed dispersal.* P. S. No. 48.

November 3. *The work of the Brooklyn Botanic Garden.* Marcy Avenue Baptist Church Auxiliary Meeting. At the Garden.

November 3. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 113. At the Garden.

November 8. *The meaning of a flower.* P. S. No. 48.

November 12. *Collections.* Birch Wathen School, New York.

November 13. *Children's educational work at the Brooklyn Botanic Garden.* The National Recreational School. At the Garden.

November 15. *Fall fruits.* P. S. No. 48.

November 16. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 35. At the Garden.

November 16. *The children's work at the Brooklyn Botanic Garden.* Woman's Auxiliary of the Brooklyn Botanic Garden.
November 18. *Thanksgiving.* P. S. No. 139.
November 22. *Thanksgiving.* P. S. No. 48.
November 24. *Thanksgiving.* Birch Wathen School, New York.
November 29. *Fruits in City markets.* P. S. No. 48.
December 6. *Economic plants.* P. S. No. 48.
December 24. *Christmas greens.* P. S. No. 36.

By the Curator of Public Instruction:

January 19. *The life of plants.* Headquarters of School Nature League, P. S. 62, Annex. Manhattan.
January 27. *The present status of the American chestnut.* Torrey Bot. Club, N. Y. Bot. Gard., Museum Building.
January 27. *Trees and shrubs of ornamental value for the home grounds.* Madison Garden Club, Madison, N. J.
January 27. *Graduation address.* P. S. 47, Brooklyn.
March 1. *Diseases of trees.* Natural Sci. Club of Hunter College.
March 5. *Common trees.* Scout Troop 66. Emmanuel Baptist Church, Brooklyn.
March 26. *The conservation of our native wild flowers.* Troop 2, Central Y. M. C. A., Brooklyn.
March 29. *Conservation of wild flowers.* P. S. 66, Brooklyn.
April 6. *The work of the Brooklyn Botanic Garden.* St. Mark's Church, Ladies' Aid Society, Brooklyn.
April 12. *Conservation.* Manual Training High School Annex. Brooklyn.
April 15. *Forestry in the United States.* Contemporary Club, at the Brooklyn Bot. Gard.
April 20. *The structure of seeds.* Headquarters of School Nature League, P. S. 62, Annex. Manhattan.
April 21. *Arbor Day.* Waverly Annex of Boys' High School, Brooklyn.
April 22. *Conservation.* Manual Training High School Annex, Brooklyn.

April 26. *Economic plants in the greenhouses of the Brooklyn Botanic Garden.* Girls' Commercial High School, at the Brooklyn Bot. Gard.

May 3. *Forestry.* Girls' Commercial High School, at the Brooklyn Bot. Gard.

May 21. *The work of the Brooklyn Botanic Garden.* N. Y. Public Library School, at the Brooklyn Bot. Gard.

June 3. *The Brooklyn Botanic Garden.* Thomas Jefferson High School Annex (P. S. 70).

June 18. *How the plant lives and grows.* Ave. A. Gardens of the National Plant, Flower and Fruit Guild, Manhattan.

July 1. *Forestry.* Lecture to candidates for N. Y. C. biology teachers' license. Y. M. C. A. West 57th St., Manhattan.

October 6. *Our native trees.* Morristown Garden Club, Morris Plains, N. J.

October 18. *The life of the tree.* Boy Scouts and Scoutmasters, Children's Museum, Brooklyn.

December 17. *What forestry is.* Natural Science Club, Hunter College, Manhattan.

By the Assistant Curator of Elementary Instruction:

January 15. *Nature study for Scouts.* To Girl Scout Captains. At the Garden.

November 16. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 57. Queens.

December 13. *Christmas greens and Christmas myths.* P. S. No. 48.

By Instructors:

May 4. *Nature study for children.* Mothers' Club, P. S. No. 47. Miss Woodward.

May 27. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 129. Mrs. Free. At the Garden.

October 11. *The value of children's gardens.* Garden Club, Wilton, Conn. Mrs. Free.

October 21. *The work of the Brooklyn Botanic Garden.* Mothers' Club, P. S. No. 113. Miss Woodward.

By the Horticulturist:

January 28. *Rock gardens.* Garden Club of Ithaca, Ithaca, N. Y.

March 1. *Rock gardens.* Rutgers University, New Brunswick, N. J.

March 10. *Seed catalogues, cold frames, spring planting.* Maplewood Garden Club, Maplewood, N. J.

April 13. *English gardens.* Torrey Botanical Club, New York.

April 14. *Spring planting.* Station WNYC, New York.

April 19. *Budding and grafting.* Nature Study Class, Hunter College, Brooklyn Botanic Garden.

April 20. *Budding and grafting.* Nature Study Class, Hunter College, Brooklyn Botanic Garden.

May 27. *Rock gardens.* Millbrook Garden Club, Millbrook, N. Y.

August 28. *English gardens.* N. Y. Botanical Garden, New York.

September 28. *Shrubs and plants.* Ditmas Park Association, Brooklyn, N. Y.

October 19. *House plants.* N. Y. C. Gardens Club, Brooklyn Botanic Garden.

October 19. *English gardens.* Department of Botany, Brooklyn Institute of Arts and Sciences, Brooklyn Botanic Garden.

October 27. *House plants.* Plainfield Garden Club, Plainfield, N. J.

By the Curator of Plant Breeding and Economic Plants:

April 11. *Bolivian trails.* Briarcliff Community Club, Briarcliff, N. Y.

May 14. *Heredity and variation in plants.* Biology classes, Manual Training High School. At the Garden.

June 8. *Economic plants of South America.* Geography classes, Maxwell Training School for Teachers, Brooklyn. At the Garden.

July 24. *The Japanese Garden.* Reconciliation Trips. At the Garden.

September 11. *Bolivian trails.* Public lecture, New York Botanical Garden.

October 1. *Heredity and variation in plants.* Biology classes, Manual Training High School. At the Garden.

November 16. *Economic plants and the geography of South America.* Advanced Geography Classes, Maxwell Training School for Teachers, Brooklyn. At the School.

December 7. *Bolivian plants and peoples.* General Assembly. James Madison High School, Brooklyn.

December 17. *The nature, causes, distribution, and prevalence of fasciation with reference to the problems of genetics.* Biological Seminar. Princeton University.

December 28. *The origin by mutation of differences in cold-resistance in the same plant species.* (Read by title.) Genetics Section, Botanical Society of America, Philadelphia.

By the Registrar and Custodian:

January 12. *Identification of trees by leaves.* 23d Regiment Armory, Brooklyn.

May 1. *Use and beauty of our American trees.* Brooklyn Institute, Academy of Music, Brooklyn.

May 26. *Flowers, wild and cultivated.* Franklin K. Lane H. S., Brooklyn.

June 21. *Wild flowers and ferns and their conservation.* Children's Museum, Brooklyn.

June 25. *Presentation of medal.* Troop 24, B. S. A., St. Mark's M. E. Church, Brooklyn.

By the Librarian:

May 21. *Brooklyn Botanic Garden library, its organization and work.* Library School of the New York Public Library. At the Garden.

June 25. *Books and world power.* New York Library Association, Lake Placid, N. Y.

By the Curator of Plants and Plantations:

September 23. *American Woodland Plants.* Millbrook Garden Club.

December 15. *Colonial Garden.* Colonial Dames.

By the Curator of Plant Pathology:

May 29. *Iris and its culture.* New York Botanical Garden.

By the Curator of Plants:

February 24. *Observations on the structure of the Frankeniaceae.* Torrey Botanical Club, New York Botanical Garden.

By the Resident Investigator:

January 17. *Biological aspects of the race problem.* Flatbush Congregational Church, Brooklyn, N. Y.

February 18. *Scientific viewpoint of the anti-vaccination, anti-evolution agitation.* Men's Club, Brooklyn Ethical Culture Society, Brooklyn, N. Y.

May 10. *Ferns.* New Rochelle Garden Club, New Rochelle, N. Y.

May 26. *Saving the Hart's Tongue.* Brooklyn Botanic Garden.

APPENDIX 5

REPORT ON BROOKLYN BOTANIC GARDEN PUBLICATIONS, 1926

American Journal of Botany

Published in cooperation with the Botanical Society of America. Volume XIII (1926) comprised ten issues, as usual, monthly (omitting August and September), with 47 papers and 783 pages, an increase of 116 pages over 1925. There were 46 plates and 170 text figures. The increase in the number of pages indicates an increase in the amount of botanical research material being offered for publication, and was made possible by the plan providing for the prompt publication of papers when the entire cost of publication is met by the author or the institution with which he is connected. Sixteen papers were published on this plan. Prof. C. E. Allen, University of Wisconsin, continued as editor-in-chief, and Dr. Arthur Harmount Graves as member of the editorial board representing the Brooklyn Botanic Garden.

Ecology

Published in cooperation with the Ecological Society of America. The four issues of Volume VII (1926) comprised 38 papers and 523 pages (an increase of 50 pages over 1925), 7 plates, and 63 text figures. Major Barrington Moore continued as Editor-in-chief, and Mr. Norman Taylor as representative of the Brooklyn Botanic Garden on the editorial board.

Genetics

Published bi-monthly in cooperation with the Editorial Board of Genetics. Five numbers were issued during the year, namely, those for the months of September and November (1925), and January, March and May, 1926 (issued in October). Delays in the publication of the succeeding issues have been due to causes beyond the control of the editors and management. The numbers issued in 1926 comprised 27 papers occupying 504 pages.

Brooklyn Botanic Garden Record

Volume XV of the quarterly RECORD (1926) comprises, as usual, the annual *Delectus Seminum,* or list of seeds offered in exchange with other Gardens, the *Annual Report,* the educational *Prospectus,* and miscellaneous articles and notes concerning the Botanic Garden. Volume XV comprised 180 pages. It is becoming desirable that the *Record* shall appear at bi-monthly intervals, and we hope that this may be brought about by not later than 1928.

Leaflets

Ten numbers of Series XIV of this popular publication have been issued. Their popularity increases yearly, as well as the geographical extent of their circulation. Various numbers have been in demand for class instruction in both high schools and colleges in cities located in several different states. The demand for certain numbers has been so great as to necessitate reprinting them.

Contributions

Numbers 46 and 47 appeared during the year, and numbers 48 and 49 had been accepted for publication and will appear early in 1927.

Research Published

The total number of research papers (of members of the staff and others) published during 1926 was 114, occupying 1,820 pages, as against 1,824 pages of research published in 1925 and 1,683 in 1924.

Subsidies Received

Contributions of research papers are received by the editors of our three research journals faster than we are able to publish them. Enough manuscript is usually on hand to fill an entire volume, so that a paper cannot get published in less than ten or twelve months after it has been accepted.

This situation was presented to the National Research Council and the Council voted a subsidy of $500 (as also in 1925) to *American Journal of Botany* and a like subsidy to *Ecology* (in 1926 only) for the purpose of enabling the journals to publish more pages and thus, in a measure, relieve the congestion.

The "author-payment" plan, referred to above under *American Journal of Botany,* has served to relieve the congestion in the editorial office of that journal.

APPENDIX 6

MEETINGS OF ORGANIZATIONS AT THE GARDEN, 1926

January 8. Girl Scouts.
January 16. Girl Scout Captains.
January 16. League of Neighbors.
January 23. Woodcraft League.
April 8. New York Bird and Tree Club.
April 15. Contemporary Club.
May 4. Mothers' Club, P. S. 47.
May 4. Winter's Night Club.
May 8. League of Neighbors.
May 8. International House Group.
May 12. Heads of Department Association.
May 15. Torrey Botanical Club.
May 17. Bayside Garden Club.

May 18. Mothers' Club, P. S. 89
May 19. American Association of Museums.
May 20. Brooklyn Kindergarten Association.
May 21. New York Library School.
May 25. Mothers' Club, P. S. 139.
May 25. Mothers' Club, P. S. 199.
May 25. Mothers' Club, P. S. 217.
May 25. Mothers' Club, P. S. 183.
May 26. American Fern Society.
May 26. Federated Garden Club of N. Y. State.
May 26. New York Bird and Tree Club.
May 26. Torrey Botanical Club.
May 26. Wild Flower Preservation Society.
May 27. Mothers' Club, P. S. 129.
June 1. Lewis Avenue Church Auxiliary.
June 2. Mothers' Club, P. S. 108.
June 4. Mothers' Club, P. S. 141.
June 12. Mothers' Club, P. S. 57.
June 13. Inkowa Club.
June 13. Mothers' Club, P. S. 130.
July 24. Reconciliation Trips.
August 2. School Garden Teachers' Conference.
August 14. International Conference on Flower and Fruit Sterility.
September 25. Brooklyn Institute, Department of Zoology.
October 13. Columbia Dames.
October 13. Mothers' Club, P. S. 130.
October 19. City Gardens Club.
October 19. Department of Botany, Brooklyn Institute of Arts and Sciences.
November 3. Women's Benevolent Society of Marcy Avenue Baptist Church.
November 3. Mothers' Club, P. S. 113.
November 13. National Recreational School Mothers' Club, P. S. 35.
November 19. Garden Teachers' Association.

Total, 46 organizations.

APPENDIX 7

FIELD TRIPS CONDUCTED

By the Director:

May 8. Official group from International House. Botanic Garden.

May 8. Reconciliation Tours. Botanic Garden.

By the Curator of Public Instruction:

March 28. Torrey Botanical Club. Palisades Interstate Park.

August 1. Torrey Botanical Club. Kissena Park, Flushing.

September 25. Botanical Department, Department of Education, Brooklyn Institute of Arts and Sciences. Kissena Park, Flushing.

By the Curator of Plant Breeding and Economic Plants:

May 8 and July 24. Reconciliation Trips. Japanese Garden, Brooklyn Botanic Garden.

By the Curator of Plants and Plantations:

July 25. Torrey Botanical Club. Point Lookout, Long Island.

By the Registrar and Custodian:

January 23. Woodcraft League. Brooklyn Botanic Garden and Prospect Park.

June 13. Inkowa Club. Brooklyn Botanic Garden and beehive demonstration.

June 19. Wachung Council Boy Scouts of America, Duke's Park, Somerville, N. J.

June 19–20. Bound Brook Boy Scouts in camp. Millstone, N. J.

August 21–22. Camp Lenape, B. S. A., Oakland, N. J.

August 29. Torrey Botanical Club. Van Cortlandt Park and Woodlawn Cemetery.

September 25. Brooklyn Institute. Brooklyn Botanic Garden and beehive demonstration.

October 2. Brooklyn Institute, Department of Botany. Duke's Park, Somerville, N. J.

APPENDIX 8

REPORT ON PHOTOGRAPHIC WORK, 1926

Negatives on file December 31, 1925	5,720
Negatives accessioned during 1926	280
Total negatives on file December 31, 1926	6,000
Lantern slides on file December 31, 1925	4,422
Lantern slides accessioned during 1926	58
Total lantern slides on file December 31, 1926	4,480
Prints on file December 31, 1925	2,046
Prints made during 1926	2,273
Used or distributed	1,940
Filed	330
Total prints on file December 31, 1926	2,376
Enlargements made	16

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Through Other Departments	294	310
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Through the Botanic Garden	24	
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Total		1220

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GENERAL INFORMATION

Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 1000 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park Station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS
OF THE
BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, seed list, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I, *Dedication Papers:* comprising 33 scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. 521 pages. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. By Norman Taylor, June 11, 1923. 108 pages. Price $1.00, plus postage.

Volume III. Vegetation of Mount Desert Island, Maine, and its environment. By Barrington Moore and Norman Taylor. 151 pages. *In press.*

CONTRIBUTIONS. Established, April 1, 1911. Papers originally published in periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

41. Factors influencing the infection of wheat by Tilletia Tritici and Tilletia laevis. 24 pages, 4 plates. 1924.

42. Variation among the sporelings of a fertile sport of the Boston fern. 27 pages, 15 figures. 1924.

43. Inheritance studies in Pisum. V. The inheritance of scimitar pod. 14 pages, 10 figures. 1925.

44. Modes of infection of sorghums by loose kernel smut. 17 pages, 3 plates. 1925.

45. The inheritance of resistance of oat hybrids to loose smut. 19 pages. 1925.

46. Geographical distribution and the cold-resisting character of certain herbaceous perennial and woody plant groups. 10 pages. 1926.

47. The cause of the persistent development of basal shoots from blighted chestnut trees. 7 pages, 1 figure. 1926.

48. Further evidence of physiologic races of oat smuts. 8 pages. 1927.

49. Chromosome and gene mutations in Datura following exposure to radium rays. 5 pages. 1927.

50. The climate of Long Island; Its relation to forests, crops, and man. 20 pages, 2 plates. 1927.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Established, December, 1914. Since 1925 issued each year in the January number of the RECORD.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published, in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $7.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly Subscription, $6.00 a year.

BROOKLYN BOTANIC GARDEN RECORD

VOL. XVI JULY, 1927 NO. 3

RESEARCH

AT THE

BROOKLYN BOTANIC GARDEN

1910-1927

"I am especially interested in the enlargement and improvement of botanic gardens for I believe that these institutions offer opportunities for a thorough investigation of many important long-time problems which are difficult, if not impossible, for any other institution to satisfactorily provide."

—*W. M. JARDINE,*
Secretary of Agriculture.

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RESEARCH

AT THE

BROOKLYN BOTANIC GARDEN[1]

PRELIMINARY STATEMENT

" . . . for the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects." (*Laws of New York, 1897, Chapter 178.*)

The following pages are offered as a brief survey and report of the botanical research carried on at the Brooklyn Botanic Garden from its establishment in 1910 to date.

In the *Act* of the New York State Legislature, authorizing the City of New York to enter into agreement with the Trustees of the Brooklyn Institute of Arts and Sciences for the establishment of a Botanic Garden in Brooklyn, it is specified, as quoted above, that the Garden shall include in its activities the advancement, as well as the diffusion, of knowledge.

In the *Agreement* of December 28, 1909, between the City of New York (through its Board of Estimate and Apportionment) and the Trustees of the Brooklyn Institute of Arts and Sciences, concerning the establishment of the Garden it is provided, in paragraph sixteen, that the director (there called the " Chief botanist ") and other members of staff *" shall make botanic researches . . . and that they shall labor to the best of their ability for the advancement of botanical science."*

Thus, from the beginning, botanical research has been an essential and, in fact, an obligatory function of the Garden, correlative with botanical education.

Even before the site of the Garden had been turned over to our Trustees for administration, and while the three or four persons that constituted the Garden Staff were occupying temporary quar-

[1] Brooklyn Botanic Garden Record, Vol. XVI, No. 3, July, 1927.

ters in the Brooklyn Museum building, investigations were well under way on the Local Flora, Plant Physiology, and Plant Pathology, and by the year 1921 there had been published twenty-five numbers of the Brooklyn Botanic Garden *Contributions* embodying some of the results of these studies, and also Volume I of Brooklyn Botanic Garden *Memoirs,* 500 pages, comprising thirty-three research papers presented by members of the Garden Staff and visiting botanists at the dedication of the Laboratory Building in 1917.

Botanical research was, therefore, the first work initiated by the Garden, practically contemporaneous with the preliminary administrative activities.

From the beginning, it was planned to emphasize the experimental aspects of botany, with due attention also to studies of the vegetation within a radius of 100 miles of Brooklyn (the Local Flora area as defined some years previously by the Torrey Botanical Club.)

This decision was made not only because generous provision already existed in a sister institution for the advancement of Systematic Botany, but also because of the great theoretical and practical importance of the problems of experimental botany. Moreover, although the institutions and individuals then engaged in experimental studies were producing results of a high order of merit, the provision for this work was meagre, out of all proportion to its great importance.

The United States Department of Agriculture, through its Bureau of Plant Industry and other Bureaus, and the State Agricultural Experiment Stations were then, as now, attacking with vigor and ability the innumerable problems of applied botany, with special reference to agriculture; but the effectiveness of such research is always governed by the state of our knowledge of fundamental principles and facts that may be applied in practice. It is, of course, a truism that we can have no applied science unless we first have something to apply. For this we are dependent upon research in so-called "pure" science. It was for the purpose of helping to meet this need that the research program of the Brooklyn Botanic Garden was organized.

Largely, though not exclusively, confined to pure science, this

program aimed to include studies that would yield results of more than mere academic interest—results that were fundamental to the solution of problems in applied botany.

Certainly no line of work could be more logical for an urban institution. The City has square miles of area in parks and watersheds planted with trees and shrubs and laid out as lawns or grassland. For all of its food the City is dependent upon agriculture and should (in its own interest, if through no higher motive) contribute whatever it can to make agriculture and horticulture more efficient. The breeding of a new food plant, or the discovery of how to control a plant disease destructive of crops, operates in a very direct manner to reduce the cost of food to the consumer in the city—not to speak of the high value of advancing knowledge for its own sake.

The *Seventh Annual Report* of the Botanic Garden (for 1917) contained the following statement:

"Fundamental to all else is research. The greatest need of botany, the greatest need of the people from botany, is a deeper and wider knowledge of the principles of plant life and their practical application in agriculture, horticulture, floriculture, forestry, plant pathology, and other applied sciences. The judicial expenditure of very large sums for botanical research can be justified, not only from the scientific, but also from the financial point of view. . . . No error could be more disastrous than an attempt to build here a superstructure of public education concerning plants, without a suitable foundation in botanical research."

In our *Eighth Annual Report* the matter was again emphasized with the statement that,

"Nothing is now more important for us than to bend every effort to realize our plans, which include the increase as well as the diffusion of a knowledge of plant life. . . . I feel that the Brooklyn Botanic Garden is now at a critical stage of its development with reference to this particular work. Steps should be taken as soon as possible for the establishment of several research curatorships, with the necessary assistants and equipment, and provisions for publishing the results of research."

Again, in the *Ninth Annual Report* (for 1919), the subject was stressed, with special reference to the need of pure science re-

search in Plant Pathology, and the favorable location of the Garden to become a center of such work.

In response to these statements, the late Mr. Alfred T. White, "Father of the Brooklyn Botanic Garden," held several conferences with the director, and expressed his lively interest in the development of research at the Garden, and his belief that it should be placed upon a firm financial foundation. The matter was also discussed several times by the Botanic Garden Governing Committee. Under date of November 15, 1920, Mr. White, then Chairman, addressed to the Committee a letter, offering, on behalf of himself and two other friends of the Garden, "to provide in the next four years; that is, 1921, 1922, 1923, and 1924, a total sum of fifty thousand dollars ($50,000), available for this new Department (*i.e.*, Plant Pathology), payable, if needed, to the amount of $20,000 the first year, $15,000 the second, $10,000 the third, and $5,000 the fourth. The object in naming the larger sums the first two years is to cover the costs of providing necessary equipment for this Department, which will be needed as soon as it is set up. . . . Some time before the close of the four years it is reasonable to hope that the City may enlarge its annual appropriation for the support of the Garden sufficiently to provide for this Department in later years."

In the same letter Mr. White also expressed the hope that the results of the work would "so commend themselves as to enable us to secure from some of the Foundations a permanent endowment for this important Department. "I believe," he added, "that the establishment of this Department will add both to the reputation and usefulness of the Garden."

This wise and generous gift made possible the creation of a research curatorship, and the appointment of the first incumbent, Dr. George M. Reed, of the U. S. Department of Agriculture, as Curator of Plant Pathology.

The stimulus of this gift, and the new work made possible by it, was felt in all departments of the Garden, for nothing encourages a body of scientific workers more than the assurance that they have the understanding sympathy and support of a body of trustees.

Mr. White's gift also strengthened the Garden in numerous

ways correlative with the stimulus to research—such as the extension of the herbarium, the library, and the collections of living plants, the more efficient care of the latter in the matter of disease detection and control, the strengthening of our bureau of public information, the improvement of our service to the public schools, and the enrichment of our popular and technical publications.

To the great sorrow and regret of us all Mr. White was not privileged to see the gratifying results of the work he had made possible, for the Garden was deprived of his wise counsel and support by his untimely and accidental death on January 29, 1921.

By the terms of Mr. White's gift it was provided that the principal sum was to be expended over a period of three years, but by wise economies the amount available was made to cover a four years' program.

Mr. White's expressed hope that, by the end of the three-year period, some of the existing foundations would provide for the continuation of the work was not realized; but three friends of Mr. White and of the Garden, after conference with the Chairman of the Division of Biology and Agriculture, of the National Research Council, made the generous offer to underwrite the work for $7,500 a year for another three-year period. No gift to the Garden ever met a more urgent need or put more heart into the administration—not alone for the financial support thus assured, but for the confidence in the work and the understanding of the real character and purpose of the Garden of which it gave such substantial evidence. This pledge will carry the work to the close of the year 1928. Between now and then it is hoped that provision may be found for placing our Plant Pathology and also our other research projects on a permanent financial basis.

The following more detailed accounts of the past, present, and future of our research work have been prepared by those having it in charge.

This entire statement is offered as a report of progress, to give detailed information primarily to those who have administrative and financial responsibility for this work, and frankly in the hope that this statement may help to win sufficient confidence and disclose so urgent a need as to secure additional financial support more nearly commensurate with the importance of the work.

The impression that obtains in some quarters that botanical research is already amply provided for in the existing governmental bureaus and stations and the botanical departments of our various universities led the writer to seek statements on this subject from a number of men whose opinion on such a matter should have weight. These statements are included on pages 182–188 following.

The director of the Garden would be glad to correspond or confer with anyone who might be interested to learn more of this work and to inspect it at first hand with a view to becoming better acquainted with its nature and needs.

C. Stuart Gager.

BEARDLESS IRIS PROJECT

Scope:

The study of Beardless Irises is carried out in cooperation with the American Iris Society. The main studies are concerned with the Japanese varieties, which are commonly referred to as *Iris kaempferi*. The project includes:

1. The identification of varieties and the nomenclature.
2. Accurate description and illustration of varieties.
3. Classification based upon color and other features.
4. Problems in the culture of the Iris, including soil conditions, fertilizing, diseases, etc.

Status:

The project has involved getting together as complete a collection of varieties as possible. During the past years special efforts have been made to secure varieties from all available sources. At present we have a fairly complete collection upon which to base the studies.

Accurate descriptions and watercolor illustrations of many varieties have been made, and some definite information regarding their culture is now available.

Plans:

In order to complete the study of these Irises it will be necessary to secure further varieties. Since new ones are being added

to the trade every year it will be necessary to obtain these from the introducer. Further experiments on culture, etc., are very essential.

Personnel:

GEORGE M. REED, *Curator of Plant Pathology* (*1921–*). See Personnel under "Pathology," p. 167.

MONTAGUE FREE, *Horticulturist* (*1924–*). Gardener, University Botanic Garden, Cambridge, England, and student of botany, Cambridge Technical School (1899–1906); Propagator, Warley Place Gardens, Essex, England (1906–1908); Student gardener and Sub-foreman (Alpine department), Royal Botanic Gardens, Kew (1908–1912). Certificates from Kew and from Royal Horticultural Society (Public Parks examination). Assistant gardener, N. Y. State College of Agriculture, Cornell University (1912–1913); Instructor in Horticulture and Superintendent of Greenhouses, School of Horticulture for Women, Ambler, Pa. (1913); Engaged in landscape gardening and commercial work (1913–1914); Head Gardener, *Brooklyn Botanic Garden* (1914–1920); Horticulturist and Head Gardener (1920–1924).

MARJORIE R. SWABEY, *Research Assistant* (*1926–*). See Personnel under "Pathology," p. 167.

CLASSIFICATION OF PLANTS

Project 1. The Classification and Evolution of the Frankeniaceae

Scope:

The study of floral structures, giving special attention to placentation.

Status and Plans:

The Frankeniaceae, classified by the older botanists (including Bentham and Hooker) near the Caryophyllaceae, but by Engler near the Tamaricaceae, show striking resemblances to both these groups. The definite recognition of such a double relationship would give the Frankeniaceae an important posi-

tion in the general classification of the Dicotyledons. In this connection a better understanding of their internal relationships would be desirable. The distribution of the family in widely scattered regions, such as Western North America, Southern South America, the Mediterranean Region, South Africa, and Australia, makes this question of special interest. Material and data have been accumulated, and work will be continued along the lines indicated.

Project 2. The Classification of Dicotyledons

Scope:

A study of the floral structures supposedly primitive in various families, and the geographical distribution of the supposedly primitive genera compared with that of the families.

Status:

In such groups as the algae, ferns, and gymnosperms modern views of classification have gradually replaced the old pre-evolutionary systems. For the great group, the Dicotyledons, it is generally admitted that the old divisions, such as Apetalae, Polypetalae, Sympetalae, have no real natural basis. Yet at the same time other proposed arrangements have not become established upon sufficiently convincing bases to gain any very wide acceptance. Studies already made have related largely to the comparative anatomy of flower structures and of flower buds, especially of placentation and seeds; notes and drawings have accumulated along these lines. Papers have been presented at various times before the Torrey Botanical Club and the Systematic Section of the Botanical Society of America, and abstracts of these papers have been published in *Torreya*. My European trip in 1926 afforded opportunity for conferences on this subject with various systematists, and for the study of plant material in numerous herbaria.

Plans:

To continue the investigation along the lines above indicated.

Project 3. Nomenclature

Correspondence during the past four years (1923–26) with botanic gardens and other botanic centers in this country and

abroad has been published from time to time in a series of seven "International Seed Exchange Communications." The object of this correspondence is to establish, if possible, an "International List of Genera of Plants in Cultivation." *Communication No. 7* appeared in May, 1926.

Personnel for Projects 1, 2, and 3:

ALFRED GUNDERSEN, *Curator of Plants (1924–)*. A.B., Stanford University (1897); A.M., Harvard (1907); Docteur de l'Universite de Paris (1910). Student, University of Minnesota (1897–1900); Graduate Student, Harvard (1907); Graduate Student, Universities of Lille and Paris (1907–1910). Teacher of Botany, High School, Sauk Center, Minn. (1901); Teacher of Biology, High School, Greeley, Colo. (1901–1903): Assistant in Physics, Wesleyan University, Middletown, Conn. (1904–1905); Assistant, Arnold Arboretum, chiefly in connection with nomenclature in the *Bradley Bibliography* (1910–1913); Herbarium Assistant, *Brooklyn Botanic Garden* (1914–1915); Assistant Curator of the Herbarium (1916–1919); Assistant Curator of Plants (1920); Associate Curator of Plants (1921–1924).

Publications:

A sketch of plant classification from Theophrastus to the present. Torreya **18**: 212–219, 231–239. 1918.

Plant families, a plea for an international sequence. New Phytologist **19**: 264–271. 1920.

Evolution in flowering plants. Leaflets XI, No. 9. 1923.

International seed exchange. "Communications," Nos. 1–7, on the subject of the possibility of securing the adoption of an International List of Plant Families and of the Genera of Plants in Cultivation. 1923–1926.

Is an international list of genera of cultivated plants possible? Science **62**: 589. 1924.

Some questions relating to the classification of flowering plants. Leaflets XIII, 10. 1925.

The need of an enlarged list of botanical nomina conservanda. Science **64**: 182–183. 1926.

ECOLOGY AND PLANT GEOGRAPHY AND FLORA OF LONG ISLAND, NEW YORK

Project 1. Vegetation of Long Island, New York

Scope:

A study of the vegetation types of the island and the factors of their environment.

Status:

Montauk and other grasslands reported upon or ready for publication.

Forests: Not yet completed.

Salt marshes: Not yet completed.

Plans:

To complete field work and laboratory studies on

a. Forests of Long Island.

1. Description of types, and successional trends.
2. Completion of study of soil potentialities of the island as related to production of forest and agricultural crops.
3. Securing data on relation of stages of succession as correlated with soil fertility, humus accumulation, and hydrogen-ion concentration; the time relation of these; the effects of vegetation types on the site.
4. Continuing study of climatic factors involved, especially evaporation and wind movement and their effect upon plant transpiration and plant distribution.

b. Salt marshes of Long Island.

1. Continuing work on distribution of vegetation on the drained and undrained salt marshes, particularly with reference to availability of salt marsh mucks for agricultural purposes. The relation of salt-tolerant species to varying degrees of salinity in tidal creeks and marshes.

Project 2. Flora of Long Island, New York

Scope:

A complete flora, with keys to the species, their frequency, distribution, times of flowering, and evolutionary history of the flora.

Status:

Over twenty thousand specimens and practically all printed records of the flora have been tabulated on species maps. On these outline maps, one for each species, has been plotted all available information to date.

Plans:

To complete field work and herbarium studies in order that the flora may, within the next two or three years, be published as a *Memoir* of the Garden. This involves collection of several thousand additional specimens and considerable walking over little known parts of the island.

Project 3. Ecological Survey of Allegany State Park, Salamanca, New York

Scope:

A survey of this State Park, for the preparation of a report on the vegetation, suitable for distribution to the general public, but primarily for the accumulation of accurate data on its forests and other vegetation types.

Status:

To be completed during summer of 1927.

Plans:

To complete the field work during the summer of 1927, and to prepare a report for publication by the New York State Museum at Albany, under whose auspices, with the cooperation of the Garden, the work is planned. To be published also as one of the *Contributions* of the Brooklyn Botanic Garden.

Project 4. Vegetation of Mount Desert Island, Maine, and its environment

Scope:

A study of the vegetation types of this island, particularly of the different forest associations, and an instrumental study of the factors of the environment.

Status:

Field work and laboratory tests of soils completed during seasons of 1920–1923. Project completed with publication of results as Volume III of the *Memoirs* of the Brooklyn Botanic Garden, issued June 10, 1927.

Personnel:

Norman Taylor, *Curator of Plants* (*1927–*). Cornell University (1900–1901). Museum Aid, New York Botanical Garden (1904–1907); Custodian of the Plantations (1908); Assistant Curator (1909–1911). Curator of Plants, *Brooklyn Botanic Garden* (1911–1920); Curator of Plants and Plantations (1921–1926). Editor, *Torreya* (1911–1922); Editor, *Journal International Garden Club* (1917–1920); Associate editor, *Ecology* (1920–).

Barrington Moore, Editor of *Ecology*. (For Project 4, only.)

Publications 1911–1927

Local flora notes. Torreya 11: 170–174, 186–189. 1911.

Some modern trends in ecology. Torreya 12: 110–117. 1912.

On the origin and present distribution of the pine-barrens of New Jersey. Torreya 12: 229–242. 1912.

Plants collected on the South Georgia Expedition. Brooklyn Mus. Sci. Bull. 2: 60–63. 1914.

Flora of the vicinity of New York; a contribution to plant geography. N. Y. Bot. Gard. Memoirs 5: 1–683. 1915.

The growth-forms of the flora of the vicinity of New York. Am. Jour. Bot. 2: 23–31. 1915.

Endemism in the flora of the vicinity of New York. Torreya 16: 18–28. 1916.

A white cedar swamp at Merrick, Long Island, and its significance. N. Y. Bot. Gard. Memoirs 6: 79–88. 1916.

Quantitative study of Raunkiaer's growth-forms as illustrated by the 400 commonest species on Long Island, New York. Brooklyn Bot. Gard. Memoirs 1: 486–491. 1918.

Plants and animals of Mount Marcy, New York. Ecology 1: 71–94, 204–233, 274–288. 1920. (With others.)

Endemism in the Bahama flora. Ann. Bot. 35: 523–532. 1921.

Plant composition and soil acidity of a Maine bog. Ecology **2**: 258–262. 1921. (With B. Moore.)
Vegetation of Montauk; a study of grassland and forest. Brooklyn Bot. Gard. Memoirs **2**: 1–107. 1923.
Age and area. Ecology **8**: 283–284. 1927.
The climate of Long Island. New York (Cornell) Agr. Exp. Sta. Bull. **458**: 1–20. 1927.
Vegetation of Mount Desert Island, Maine, and its environment. Brooklyn Bot. Gard. Memoirs **3**: 1–151. June 10, 1927. (With Barrington Moore.)

GENETICS AND PLANT BREEDING

Project 1: Inheritance in plants

Scope:

1. The determination of the manner of inheritance of characters in certain plants, especially in the genus *Pisum*.

2. The determination of the interrelations of the hereditary character-determining influences or elements (factors or genes).

3. The influence of environmental differences on the expression of these hereditary units.

4. The relation between the hereditary units or factors and the chromosomes.

5. The frequency of origin and the distribution of certain characteristics.

In the prosecution of these studies, it is planned to employ the best available material. So far, peas have been largely used, because they have many peculiar advantages over other plants. To some extent, castor beans, maize, and *Nicotiana* have been employed.

Status:

Studies on the inheritance of fasciation and other striking abnormalities in *Nicotiana, Chenopodium, Celosia, Erigeron,* maize, and other plants have been carried out and reported on in published form. Some types of fasciation (ribbon-like stems, increase in tissue, and often distorted flowers) have been found to be primarily the result of inheritance. Other types are mainly due to special kinds of environment.

Studies of inheritance in castor beans have shown that the most extreme types of this very variable species will cross with each other, giving fertile hybrids, which in some cases are much more vigorous and give greater yields of beans. Some forms are determinate in growth (annuals), while other forms will live for many years. The inheritance of the "non-exploding" and "exploding" characters of the fruits have been investigated, as well as various pattern and color characters of the seeds and stems.

Studies on peas have resulted in bringing together practically all the species, peculiar forms and sub-species, and many of the common commercial field and garden varieties of various countries. These latter represent types from Abyssinia, Egypt, China, Japan, Chile, Persia, and the various European nations. The manner of inheritance of a large number of the characters and their interrelations with each other have been investigated. The relations between the factors so far studied indicate either extremely "loose" or very "close" linkage conditions in peas. Certain forms when crossed with each other produce semi-sterile hybrids, and these in turn produce progeny (F_2) that resemble one or the other of the grandparents and are more fertile than the F_1 parent or are absolutely sterile. Other forms when crossed together produce much more vigorous first generation progeny and give larger yields. Still other forms when crossed produce yields but slightly, if any, above the average of the parents.

Project 2: Geographical distribution and inheritance of cold-resistance

Studies on the temperature relations of plants in reference to inheritance and geographical distribution have been started. Some species appear to produce variants able to cope with lower temperatures than the majority of their individuals.

Plans:

It is planned to continue the studies along the lines indicated above (Projects 1 and 2).

Personnel for Projects 1 and 2:

Dr Orland E. White, *Curator of Plant Breeding and Economic Plants (1924–1927)*. B.S., South Dakota State College

of Agric. & Mech. Arts, 1909; M.S. 1911; M.S., Harvard, 1912; Sc.D. 1913. Instructor and research assistant in botany, S. D. S. C., 1909–1911; assistant in botany and genetics, Radcliffe, 1912–1913. Assistant curator of plant breeding, *Brooklyn Botanic Garden,* 1913–1915; Curator of plant breeding (1915–1924). Collaborator, Offices of Forage Crop and Horticultural Investigations, U. S. Department of Agriculture, 1915–1918; 1919–1923. Field specialist, U. S. Dept. Agriculture, July–Dec. 1918; Aug.–Nov. 1919. Botanist, representing Bussey Institution of Harvard and Brooklyn Botanic Garden, Mulford Exploration of the Amazon Basin Expedition, 1921–1922. Secretary, Round Table Conference on Agriculture and Population Increase, Institute of Politics, Williamstown, Mass., 1925. Editorial Board, Amer Jour. Bot., 1920–1921; Editor, Genetics Section, Bot. Abstracts, 1922–1926; Editor, Plant Genetics Section, Biol. Abstracts, 1926–

Mary Ellen Peck, *Scientific Assistant (1925–1927).* A.B., Vassar (1925); M.A., Columbia University (1927). Thesis (based on studies carried on at Brooklyn Botanic Garden): "The inheritance of striped seed coat pattern in *Pisum.*"

Graduate Students:

Stella G. Streeter (1915–1916). A.B., Smith College.

Dorothy I. Neff (1923–1925). A.B., Vassar (1922); M.A., Columbia (1925). Scientific assistant, Brooklyn Botanic Garden (1923–1925). Thesis (based on studies made at the Brooklyn Botanic Garden): "The inheritance of green and yellow foliage colour and green and yellow pod colour in *Pisum.*"

Mary Ellen Peck (1925–1927). For data, see above.

Publications (for Projects 1 and 2, 1913–1927)

The bearing of teratological development in Nicotiana on theories of heredity. Amer. Nat. 47: 206–228. 2 fig. 1913.

Formation of spurred flowers in hybrid Calceolarias. Science 36: 54. 1912.

Study of certain floral abnormalities in Nicotiana and its bearing on theories of dominance. Amer. Jour. Bot. 1: 23–36. 4 fig. 1914.

Swingle on variation in F_1 Citrus hybrids and the theory of zygotaxis. Amer. Nat. **48**: 185–192. 1914.

A new cytological staining method. Science **39**: 394–396. 1914.

Inheritance studies in Pisum. I. Inheritance of cotyledon color. Amer. Nat. **50**: 530–547. 1916.

Studies of teratological phenomena in their relation to evolution and the problems of heredity. II. The nature, causes, distribution, and inheritance of fasciation with special reference to its occurrence in Nicotiana. Zeitschr. f. Abstamm.- u. Vererbungslehre **16**: 49–185. 29 fig. 1916.

Inheritance of endosperm color in maize. Amer. Jour. Bot. **4**: 396–406. 1917.

Inheritance studies in Pisum. II. The present state of knowledge of heredity and variation in peas. Proceed. Amer. Philosoph. Soc. **56**: 487–588. 1917.

Inheritance studies in Pisum. IV. Interrelation of the genetic factors of Pisum. Jour. Agric. Research **11**: 167–190. 1917.

Breeding new castor beans. Jour. Heredity **9**: 195–200. 5 fig. 1918.

Inheritance studies on castor beans. Brooklyn Botanic Gard. Mem. **1**: 513–521. 6 plates (2 col.). 1918.

Inheritance studies in Pisum. III. The inheritance of height in peas. Mem. Torrey Bot. Club **17**: 316–322. 1 fig. 1918.

Botanical exploration in Bolivia. Brooklyn Botanic Gard. Rec. **11**: 93–105. 1922.

Die Castorbohne oder Rizinus. Handbuch der landwirtsch. Pflanzenzüchtung. 2d ed., Vol. V., pp. 197–199. 1923.

Inheritance studies in Pisum. V. The inheritance of scimitar pod. Genetics **10**: 197–210. 1925.

A leaf color seedling variation in Duguetia. Jour. Heredity **16**: 381–382. 1 fig. 1925.

Geographical distribution and the cold-resisting character of certain herbaceous perennial and woody plant groups. Brooklyn Botanic Gard. Rec. **15**: 1–10. 1926.

The Amazon valley. In "Naturalist's Guide to the Americas" (Published under auspices of Ecol. Soc. of Amer.), pp. 674–681. 1926.

Color inheritance in four o'clocks. (By Francis P. Kiernan and Orland E. White.) Jour. Heredity 17: 383–386. 1926.

The genetic analysis of peas (Pisum). (With Dorothy I. Neff.) Brooklyn Botanic Gard. Rec. 15: 60–64. 1926.

Heredity and variation in plants. Three chapters, pp. 935–1000, in "General Botany" by C. Stuart Gager, published by Blakiston. 1926.

The genetic analysis of garden and field peas (Pisum). (With Dorothy I. Neff and Mary Ellen Peck.) Brooklyn Bot. Garden Rec. 16: 26–29. 1927.

"Hardiness," mutation, and the geographical distribution of plants. Brooklyn Botanic Garden Rec. 16: 30–32. 1927.

Project 3. Descriptive Study of Variation in Nephrolepis

Scope:

1. Bud variation in the Boston Fern (*Nephrolepis exaltata bostoniensis*) and other types.

2. Variation in the spore-fertile variety (*Nephrolepis exaltata bostoniensis var. fertilis*). These studies involve the maintenance of as large a collection of distinct varieties as possible in the exhibition and experimental houses devoted to these ferns, the obtaining and experimental study of any new varieties introduced by florists, and the propagation of new varieties in the Garden collections. In this connection the possibilities are only limited by space and time available.

Status:

During the last thirteen years extensive studies along these lines have been carried out. Collections of bud sports have been accessioned to over three hundred numbers from French and English, as well as from American sources, and numerous trips have been made to florists' establishments from Massachusetts to Ohio. About one hundred distinct varieties have been raised in the Botanic Garden greenhouses, mainly in the spore-fertile series.

In this connection practical studies of the horticultural qualities of whole series of the Boston Fern sports and the others have been made, both as a measure of cooperation with florists and for the very considerable increase in technical information gained thereby. In this cooperation sets of cultivated varieties have been quite widely distributed to florists and experiment stations to be tried out for their horticultural value. The results have been published in scientific and horticultural periodicals.

Project 4. Comparative Morphology and Phylogeny of Nephrolephis Types

Scope:

1. The investigation of the relative degrees of differences between feral types, bud sports, and sporeling varieties. In this problem there is involved the possible determination of the systematic value of various anatomical differences among the different forms. The Garden collections comprise a considerable series of wild species, as well as the two types of variations indicated.

Status:

The progress in this project has been made through the experimental cultivation under similar conditions of the three types of forms, and in the gradual accumulation of representative photographs and herbarium specimens. The project requires that the anatomical and morphological differences be intensively studied by histological means, and the Garden offers exceptional material for this purpose.

At the Grand Exhibition of Tropical Ferns and Orchids, held by the Massachusetts Horticultural Society in Boston, September 22–25, 1921, the Botanic Garden was awarded a special Gold Medal for its exhibit of ferns, which included 66 varieties of the Boston Fern and other forms of *Nephrolepis* (several of which originated at the Botanic Garden), and 42 different kinds of ferns not in *Nephrolepis*, chosen to give an idea of the diversity in the fern families. Twenty-five genera comprising nine families were included.

Project 5. Cytology of Sports of Nephrolepis

Scope:

1. Nuclear differences corresponding to the wide external differences among these mutations. The determination of possible chromosome differences existing among the species and the two groups of variations is a problem of very great interest.

Status:

Work has not yet been initiated, but plans are being matured.

Project 6. Conservation of Native Plants

Scope:

1. The consideration and trial of practical and experimental methods in conservation of rare native plants.

The problem of conservation of native plants comprises two quite different phases: first, the study of the situation and of what plants require conservation; second, the matter of practical methods of preventing the extinction of rare plants. This latter problem is extensively carried on by campaigns for education and the enacting of "game laws" for plants. The problem calls for consideration of experimental propagation and distribution of rare forms, and this phase touches upon matters of plant distribution.

Status:

In the popular phases of plant conservation a considerable number of articles analyzing the problem have been written and given wide distribution. Reprinting various state laws, helping in the preparation of the law for New York State (enacted April 13, 1926), lectures from the scientific standpoint, propagation and distribution of the Hart's Tongue fern (*Scolopendrium vulgare*) for naturalization purposes have been undertaken as an experimental demonstration of one fundamental method of conservation.

Plans:

To continue this and other work along similar lines.

Personnel for Projects 3, 4, 5, and 6:

RALPH CURTISS BENEDICT, *Resident Investigator* (*1916–*). Ph.B., Syracuse (1906); Ph.D., Columbia (1911); Aid, N. Y. Botanical Garden (1906–1908); Instructor in botany, Fordham University (1910–1911); High School of Commerce, N. Y. City

(1912–1916); Chairman, Dept. Biology, Bushwick High School, N. Y. City (1916–1919); First Assistant, Department of Biology, Stuyvesant High School (1919–); Instructor in botany, N. Y. University (Summer, 1910).

Publications (for Projects 3–6, 1916–1927)

Some horticultural fern variations. *Am. Fern Jour.* **6**: 8–15, pl. 1–3. March, 1916.

The origin of new varieties of Nephrolepis by orthogenetic saltation: I. Progressive variations. *Bull. Torrey Club* **43**: 207–234, pl. 10–15. June, 1916.

An Adirondack fern-list. *Am. Fern Jour.* **6**: 81–85. September, 1916.

The Nephrolepis collection at the Brooklyn Botanic Garden. *Brooklyn Bot. Gard. Record* **5**: 143–148. October, 1916. (Also published in several horticultural weeklies, *Horticulture, Florists' Exchange,* and in modified form in *Bailey's Standard Cyclopedia of Horticulture, Vol. IV.*

Nephrolepis nutrition. *Amer. Fern Jour.* **11**: 41–43. October, 1920.

Is Botrychium dissectum a sterile mutant? *Amer. Fern Jour.* **11**: 53–55. October, 1920.

Recent fern literature. *Amer. Fern Jour.* **11**: 27–29. March, 1921.

Tropical ferns. Pp. 1–8. September. (Specially printed in connection with the Fern Exhibition of the Massachusetts Horticultural Society, September 22–25.)

The Nephrolepis chart. *Gard. Chron. of America* **26**: 2. February, 1922. Printed also under various titles as follows:

The genealogy of Nephrolepis. *The Garden* **86**: 96. February 25, 1922.

Brooklyn Botanic Garden fern chart. *Flower Grower* **10**: 53. March, 1922.

Family tree of Boston fern. *Horticulture* **35**: 197. April 25, 1922.

The Boston fern and its sports, by G. Thommen [Review]. *Florists' Exchange* **53**: 1071. April 29, 1922.

The origin of new varieties of Nephrolepis by orthogenetic saltation. *Amer. Jour. Bot.* **9**: 140–157. March, 1922. Reprinted as *Brooklyn Bot. Gard. Contr.* No. 27, March.

Game laws for ferns and wild flowers. *Amer. Fern Jour.* **12**: 33–45. April–June, 1922. (Reprinted with special cover and subtitles.)

Recent fern literature. *Amer. Fern Jour.* **12**: 58–60. April–June, 1922.

Polypodium vulgare as an epiphyte. *Amer. Fern Jour.* **12**: 63–64. April–June, 1922.

Evolution as illustrated by ferns. *Brooklyn Bot. Gard. Leaflets* X^{3}. May 3, 1922.

Ferns as house plants. *Amer. Fern Jour.* **12**: 77–92. July–September, 1922. (Reprinted as *Brooklyn Bot. Gard. Leaflets* X^{9-10}. October 18.)

Variations in ferns. *Amer. Fern Jour.* **12**: 93–96. July–September, 1922.

Ferns in the news—what ferns should be protected in your state? *Amer. Fern Jour.* **12**: 98–99. July–September, 1922.

A campaign for wild plant conservation. *Amer. Fern Jour.* **12**: 131–133. October–December, 1922.

What we know about Boston ferns: What Boston ferns is best? Nine weekly articles in the *Florists' Exchange*. October 28–December 30, with the exception of December 23, 1922.

What we know about Boston ferns: What Boston fern is best? Articles in *Florists' Exchange*. January 6, February 10, 1923.

Progress of the Fern Society's program for wild plant protection. *Amer. Fern Jour.* **13**: 18–22. January–March, 1923.

Which Boston fern is best? Prospectus of an experiment to answer this question. *Jour. of Heredity* **13**: 255–263. (June, 1922.) Issued February 15, 1923.

The mosquito fern. *Amer. Fern Jour.* **13**: 48–52. April–June, 1923.

Wild plant conservation in Connecticut, a suburban state. *Amer. Fern Jour.* **13**: 56–59. April–June, 1923. (Reprinted as *Brooklyn Bot. Gard. Leaflets* XI^{5}. May 30.)

Notes on the program for wild plant protection. *Amer. Fern Jour.* **13**: 59–60. April–June, 1923.

Why study ferns? *Nature Study Rev.* **19**: 185–186. May, 1923.
Will florists aid to preserve the wild flowers? *Gard. Chron. of America* **27**: 155. June, 1923.
New bud sports in Nephrolepis. *Brooklyn Bot. Gard. Contr.* No. 32. June. (Reprinted from *Genetics* **8**: 75–95. January, 1923.)
Artificial varieties under natural conditions. Can the bud sports of the Boston fern thrive under conditions of natural selection? *Jour. of Heredity* **14**: 115–116. June, 1923.
Game laws for the conservation of wild plants. *Science* **58**: 39–41. July 20, 1923.
More fern material used by florists. *Amer. Fern Jour.* **13**: 96–97. July–September, 1923.
The moss-leaved fern. *Jour. of Hered.* **15**: 19–24. January, 1924.
The conservation of beauty. *Brooklyn Bot. Gard. Leaflets* XII[2]. April 10, 1924.
Problems in the study of the spinulose ferns. *Amer. Fern Jour.* **14**: 69–74. July–September, 1924.
Variation among sporelings of a fertile sport of Boston fern. *Jour. of Hered.* **15**: 379–394. September, 1924; **15**: 421–431. October, 1924. (*Brooklyn Bot. Gard. Contrib.* No. 42.)
The conservation of beautiy. *Brooklyn Bot. Gard. Leaflets* XIII[5-6]. June 10, 1925.
New plant conservation laws. *American Fern Journal* **16**: 59. April–June, 1926.
Saving the hart's tongue. *American Fern Journal* **16**: 33–44. April–June, 1926.

Project 7. Experimental Evolution

Scope:

To study the possible effect of radium rays in modifying the egg-cells and sperm-cells of plants in such a way as to alter inheritance. In order to study the effect of any agent in modifying inheritance it is necessary to use only pedigreed plants whose behavior as to variation and inheritance has been studied during a series of generations. Such experimental material is available

as a result of the genetical studies of Jimson Weed (*Datura Stramonium*) that have been carried on during the past several years by Dr. A. F. Blakeslee, at the Station for Experimental Evolution (Carnegie Institution of Washington) at Cold Spring Harbor, L. I. The work, for the present, will be confined to exposing egg- and sperm-cells of pedigreed plants of this species to radium rays. The project is in continuation of experiments made in 1906 in which pollen-grains and egg-cells of the Evening-Primrose (*Oenothera biennis*) were exposed to radium rays. The effects of those experiments appeared to be confined to the somatic characters of the offspring, without affecting their genetic constitution.

Status:

Using plants that had been inbred by selfing for nine generations, ovules in flower-buds of different ages were exposed to the gamma rays given off from radium emanation contained in a sealed capillary glass tube. Seeds from a single capsule, so treated, yielded plants as follows: (*a*) 17.7 per cent. chromosomal mutants (chiefly non-disjunctional forms)—a much higher percentage than has ever been obtained from untreated capsules, the average for over 15,000 offspring being 0.47 per cent.; (*b*) A new compound chromosomal type, called "Nubbin"; (*c*) Two new gene mutants out of 18 individuals tested. It is believed that the radium rays may be considered as the chief factor in producing most, if not all, of these three types of results.

Plans:

To continue and extend this work, and to make cytological studies of egg- and sperm-cells exposed to the radium rays.

Personnel for Project 7:

C. Stuart Gager, *Director* (1910–). A.B., Syracuse (1895), Sc.D. (1920); Pd.M., New York State Normal College (1897); Pd.D. (1901); Ph.D., Cornell (1902). Professor, biological sciences, New York State Normal College (1897–1905); Director of laboratories, N. Y. Botanical Garden (1906–1908); Professor of botany, University of Missouri (1908–1910).

(This project is being carried on in collaboration with A. F. Blakeslee, *Member of Staff,* Station for Experimental Evolution, Cold Spring Harbor, L. I.)

PUBLICATIONS (1916, 1927)

Present status of the problem of the effect of radium rays on plant life. *Mem. New York Bot. Gard.* **6**: 153–160. 31 August, 1916. (*Brooklyn Bot. Gard. Contributions,* No. 15.)

Chromosome and gene mutations in Datura following exposure to radium rays. *Proc. Nat. Acad. Sci.* **13**: 75–79. February, 1927. (*Brooklyn Bot. Gard. Contributions,* No. 49.) (With A. F. Blakeslee.)

PATHOLOGY

Project 1. Disease Resistance in Plants

Scope:

1. The determination of the presence or absence of resistance in particular hosts to certain parasites.

2. The influence of external conditions upon resistance and susceptibility of hosts to particular parasites.

3. The possible physiologic specialization of parasites.

4. The essential nature of disease resistance.

5. The inheritance of the disease-resistant quality.

In these studies it is planned to use whatever suitable material is available. During the past few years the investigations have been carried out with the cereals and the cereal smuts, since these offer special advantages in the prosecution of the general problem.

Status:

Extensive studies on the varietal resistance of various cereals to their specific smuts have been carried out. The more extensive experiments have been with oats and sorghum. As a result of these studies a few varieties have been found to be resistant. Some knowledge of the influence of external conditions, such as temperature, moisture and soil reaction, has been obtained and served as a basis for the prosecution of other phases of the studies.

Evidence of extensive host specialization of some of the smuts has been obtained. The existence of these races naturally complicates the problem of securing disease-resistant varieties. The progeny of various crosses between susceptible and resistant

varieties of both oats and sorghum have been extensively studied and interesting data have been obtained.

Plans:

Many unsolved problems in connection with the general project remain for solution. It is proposed to continue studies along the most promising lines. At present, studies on the inheritance of disease resistance in hybrids and the discovery of specialized races of parasites are being prosecuted.

Personnel for Project 1:

GEORGE M. REED, *Curator of Plant Pathology (1921–)*. A.B., Geneva, 1900; A.M., Wisconsin, 1904; Ph.D., 1907. Professor Natural Science, Amity (1900–1903); Assistant in Botany, Wisconsin (1904–1907); Instructor (1907); Assistant Professor of Botany, University of Missouri, 1907–1912; Instructor in Botany, New York University, summer 1912; Professor of Botany, University of Missouri, 1912–1918; Resident Investigator, *Brooklyn Botanic Garden*, summers 1916–1917; Pathologist, U. S. Department of Agriculture, 1919–1920.

MARJORIE R. SWABEY, *Research Assistant (1926–)*; A.B., Stanford University (1923); M.A., Columbia (1926); Graduate Student, Stanford (1923); Columbia (1924–).

Graduate Students:

JAMES A. FARIS, *Research Fellow (1921–1924)*; National Research Fellow (1924). B.S.A., Missouri (1916); M.A., Nebraska (1920). Professor of Botany, Junior College, St. Joseph, Mo. (1917–1918); Pathologist, U. S. Department of Agriculture (1918–1920); Pathologist, Estacion Agronomica, College of Agriculture, Santo Domingo (1920–1921). *Senior Pathologist, Tropical Research Foundation (1924–)*.

DOROTHY P. TUTHILL, *Student in Mycology and Plant Pathology (1921–1922)*. A.B., Adelphi College (Brooklyn); M.A., New York University (1922). Thesis based on studies carried out at the Brooklyn Botanic Garden on Diseases of Ornamental Plants. Graduate student, New York University (1921–1922); Teacher of Biology, Adelphi College, Brooklyn (1915–1916). Laboratory Assistant, Biology, DeWitt Clinton High School (1917–).

LAURA ALMA KOLK, *Scientific Assistant* (*1924–1925*). A.B., Wellesley (1913); M.A., Columbia (1923). Student, Summer Session, Cornell (1915). Assistant to New York State Botanist (1917–1918). Instructor in Biology, Woman's College, University of Delaware (1926–).

PUBLICATIONS, 1923–1927

(*a*) *By Dr. Reed and Collaborators:*

Varietal resistance and susceptibility of Sorghums to *Sphacelotheca sorghi* (Link) Clinton and *Sphacelotheca cruenta* (Kühn) Potter. *Mycologia* **15**: 132–143. May 1923.

The smuts of cereals: Their nature, economic importance, and the significance of recent discoveries. BROOKLYN BOT. GARD. REC. **13**: 103–124. July 1924.

Physiologic races of oat smuts. *Amer. Journ. Bot.* **11**: 483–492. July 1924.

Varietal susceptibility of wheat to *Tilletia laevis* Kühn. *Phytopathology* **14**: 437–450. Oct. 1924.

The inheritance of resistance of oat hybrids to loose smut. *Mycologia* **17**: 163–181. July–Aug. 1925.

Further evidence of physiologic races of oat smuts. *Mycologia* **19**: 21–28. Jan.–Feb. 1927.

Influence of environal factors on the infection of sorghums and oats by smuts. I. Experiments with covered and loose kernel smuts of sorghum. (With James A. Faris.) *Amer. Jour. Botany* **11**: 502–512. Oct. 1924.

Influence of environal factors on the infection of sorghums and oats by smuts. II. Experiments with covered smut of oats and general considerations. (With James A. Faris.) *Amer. Jour. Botany* **11**: 579–599. Nov. 1924.

Varietal susceptibility of oats to loose and covered smuts. (With Marion A. Griffiths and Fred N. Briggs.) *U. S. D. A. Bull.* **1275**: 40 pages. April 1925.

Sorghum smuts and varietal resistance in sorghums. (With L. E. Melchers.) *U. S. D. A. Bull.* **1284**: 56 pages. 10 pl. Aug. 1925.

Relative susceptibility of selections from a Fulghum-Swedish Select cross to the smuts of oats. (With T. R. Stanton.) *Journ. Agr. Res.* **30**: 375–391. 4 pl. Feb. 1925.

Experimental studies on head smut of corn and sorghum. (With Marjorie Swabey and Laura A. Kolk.) *Torrey Bot. Club* **54**: 295–310. 5 pl. April 1927.

(a) By Dr. Faris and Collaborator:

Anthracnose of the Boston fern. *Mycologia* **15**: 89–95. March 1923.

Factors influencing infection of *Hordeum sativum* by *Ustilago hordei*. *Amer. Journ. Bot.* **11**: 189–214. March 1924.

Factors influencing the infection of wheat by *Tilletia tritici* and *T. laevis*. *Mycologia* **16**: 259–282. Nov. 1924.

Physiological specialization of *Ustilago hordei*. *Phytopathology* **14**: 537–557. Dec. 1924.

Modes of infection of sorghums by loose kernel smut. (With George M. Reed.) *Mycologia* **17**: 51–67. 3 pl. Mar.–Apr. 1925.

Project 2. Diseases of Trees

Problem 1. Disease Resistance in the American Chestnut

Scope:

To develop a strain of the American Chestnut (*Castanea dentata*) which will resist the attacks of the chestnut blight fungus (*Endothia parasitica*).

Status:

This problem has been studied since 1918 in cooperation with the Office of Investigations in Forest Pathology, Bureau of Plant Industry, U. S. Dept. of Agriculture. A survey of the native chestnut in the New York region was made in 1918 with the purpose of locating resistant trees. Since the blight has probably been present in this region longer than in any other part of the country, it was believed that immune or partly resistant individuals could be most easily located here. Partly resistant trees were found at Inwood, Manhattan, at Hollis, L. I., and at Valley Stream, L. I. Several series of trial inoculations on these trees proved their suspected resistance to be a fact. Since that time all of the trees at Inwood and Hollis have died. Several good individuals still remain at Valley Stream.

It has been found that basal shoots develop from trees killed to the base by the blight. Experimental work has proved beyond a doubt that the roots and root collar are more resistant to the fungus than the trunk.

It has been found that many basal shoots live long enough to bear nuts and thus will reproduce the species.

Plans:

1. To continue the search for resistant stock.

2. By cross breeding the more resistant stock already found with resistant Japanese or Chinese species to develop a strain to replace the American chestnut. (The Japanese and Chinese chestnuts are not good timber trees. It should be possible to combine the greater resistance of the Chinese and Japanese species with the timber qualities of the American chestnut.)

3. To grow young trees of American chestnut, and to determine whether environmental conditions affect the quality of resistance.

4. To determine experimentally the cause of resistance.

Problem 2. The Nectria Canker of the Birch

Scope:

To work out in detail the life-history of the fungus causing the Nectria Canker of the Birch (*Betula*), to determine the amount of damage it causes in the Birch and develop methods for its control.

Status:

By inoculations made in Connecticut and Maine in 1918 and 1924, respectively, the parasitic nature of the fungus has been proved, and the belief that it is the immediate cause of the canker has been confirmed. It has been found further that the growth of the parasite is slow, and there is abundant evidence at hand to prove that it grows in the wood as well as in the living bark.

Plans:

1. By laboratory studies to work out the morphology of the fungus.

2. To determine the way in which the disease is carried to healthy individuals.

3. To determine the rate of growth of the fungus in the host.

4. To study the method of reproduction of the parasite.
5. To devise means of control of the disease.

Personnel for Project 2:

Dr. Arthur Harmount Graves, *Curator of Public Instruction (1921–)*. A.B., Yale, 1900; Ph.D., Yale, 1907; Univ. of London, 1914–15. Asst. in botany, Sheffield Scientific School, and Forest School, Yale, 1902–04; Instructor in forest botany, Forest School, 1904–06; Instructor in botany, Yale, 1906–09; Assistant Professor, 1909–14; Associate Professor of biology, Connecticut College for Women, 1916–17; Pathologist and collaborator, Office of Investigations in Forest Pathology, U. S. Dept. of Agriculture, 1918–21; collaborator, 1921– .

Hester M. Rusk, *Curatorial Assistant (1926–)*. A.B., Columbia (1912); A.M. (1917). Instructor in Agricultural Botany, Agricultural High School, University of Nebraska (1913–1915); Assistant in Botany, Barnard College (1915–1918); Instructor (1918–1920); Technical Assistant, N. Y. Botanical Garden (1920–1926).

Publications since 1921

Disease resistance in the American chestnut. Rept. 10th Ann. Meeting of Northern Nut Growers Ass'n **1919**: 60–67. 1921.

The Melanconis disease of the butternut (*Juglans cinerea* L.). *Phytopathology* **13**: 411–435. 5 fig., 2 pl. 1923.

A preliminary list of native and naturalized woody plants of Greater New York. *Brooklyn Bot. Gard. Leaflets* **13**: 7–9, 1–12. 1925.

The present continued development of basal shoots from blighted chestnut trees. *Science,* N. S. **63**: 164–165. 1926.

An unusual insect gall on scarlet oak (*Quercus coccinea,* Muench). *Torreya* **26**: 1–2. 1 text fig. 1926.

The cause of the persistent development of basal shoots from blighted chestnut trees. *Phytopathology* **16**: 615–621. 1 text figure. 1926.

HERBARIUM

The nucleus of the Brooklyn Botanic Garden Herbarium was about 300 specimens collected within the borders of the Garden during 1912. This collection was augmented the same year by the gift of Dr. E. W. Olive, then curator of public instruction, of his private herbarium of 1,000 specimens of flowering plants, and also by the purchase of 2,900 specimens of parasitic fungi. At the close of 1912 the total number of specimens was about 4,200. In accordance with a resolution of the Executive Committee of the Board of Trustees adopted on October 14, 1913, on recommendation of Mr. Alfred T. White, providing for the transfer of botanical activities of the Brooklyn Museum, with the exception of the Botanical Museum, to the Brooklyn Botanic Garden, the entire Museum Herbarium, formerly in charge of Mr. E. L. Morris, curator of natural science, was transferred to the Garden in November, 1913. At the time of this transfer, the herbarium comprised the collections of William Calverley, Rev. Charles H. Hall, Rev. George D. Hulst, Rev. J. L. Zabriskie, Edward B. Sturges, E. S. Miller, and others, including approximately 30,000 specimens of vascular plants, 5,000 bryophytes, 400 lichens and 1,800 algae. From time to time, the Herbarium has been increased by gift, exchange, collecting, or purchase. Among this material may be mentioned the following:

1. Vascular Plants

a. General Herbarium

North Eastern U. S. New York State: Mrs. O. P. Phelps, 800; N. Taylor, 500; John McCallum, 1,700; E. B. Southwick, 1,000. Eastern U. S.: E. L. Morris, 9,000 (rich in *Plantago*); W. M. Van Sickle, 4,000; R. M. Harper, 653; H. M. Denslow, 214 orchids. Indiana and S. Dakota: E. W. Olive, 1,000. Michigan: F. C. Gates, 744. Missouri: H. Eggert, 294. New Jersey: L. H. Lighthipe, 7,000. New Jersey and New York: Henry Dautun, 3,000 (not including duplicates).

Southern U. S. Arizona: J. A. Harris, 223. New Mexico: H. D. House, 1,607. Texas, etc.: L. H. Lighthipe, 150; G. W. Letterman, 150.

Western U. S. Calif. and Western States: A. A. Heller, 10,000. Montana: J. E. Kirkwod, 104. Oklahoma: W. H. Emig, 250. Washington: S. M. Zeller, 350.

Alaska: R. A. Pope, 285.

West Indies. Jamaica: J. A. Harris, 175. Porto Rico: A. Fredholm, 5,100. San Domingo, etc.: N. Taylor, 500. Trinidad: W. E. Broadway, 115.

South America. Amazon Region: Mulford Biol. Expedition, 471. Argentine: Walter Fischer, 284. Bolivia: Mulford Biol. Exploration, 642.

Europe: Mrs. C. Strieff, 250. Austria: Dr. Henry Zerny, 710. Greece: N. Ballalas, 216. North Wales: A. H. Graves, 131. Roumania: Botanic Garden, Cluj, 652.

Asia India: L. A. Kenoyer, 729. Phillippine Islands: C. A. Wenzel, 870. Punjab and Kashmir: R. R. Stewart, 522. South China: Canton Christian College, 1,549.

South Sea Islands: Whitney South Sea Expedition, 579.

b. Long Island Herbarium

Long Island Historical Society, 10,000; W. C. Ferguson, 1,380; Etta Powers, 539; A. E. Hamilton, 706; Everett P. Martin, 100; E. S. Miller, 345; J. A. Harris, 240; Fanny A. Mulford, 4,000.

c. Cultivated Plants

6,000 specimens from the Arnold Arboretum collected by Dr. Camillo Schneider. About 10,000 specimens collected in Brooklyn Botanic Garden.

2. Fungi

The Mycological Herbarium includes the following exsiccati: Bartholomew, E., North American Uredinales; Brenckle, J. F., Fungi Dakotenses; Ellis, J. B., North American Fungi; Ellis, J. B., & Everhart, B. M., North American Fungi; Fungi Columbiani; Griffiths, D., West American Fungi; Kabat & Bubák, Fungi imperfecti exsiccati; Kellerman, W. A., Ohio Fungi; Krieger, W., Schaedliche Pilze; Migula, W., Cryptogamia Germaniae, Austriae and Helvetiae; Raciborski, M., Mycotheca Polonica; Seymour, A. B., & Earle, F. S., Economic Fungi; Sydow, P., Fungi exotici,

Phycomyceten and Protomyceten, Uredineen, Ustilagineen, Mycotheca Germanica; Tranzschel, V., & Serebrianikow, J., Mycotheca rossica; Zillig, H., Ustilagineen Europas.

The Garden has the very valuable mycological collection of Dr. Franz Bubák, formerly Professor of Botany and Plant Pathology in the Royal Agricultural Academy, and Director of the Botanical Garden, Tabor, Bohemia. This collection consists of over 33,000 specimens. Many of these served as the basis for Dr. Bubák's numerous contributions to mycology and plant pathology. He described more than 500 new species of fungi and his original or type specimens are represented in the collection.

In 1918, the Garden received from Mr. Harold Wingate his collection of Myxomycetes of 130 species, including numerous type species, mostly from near Philadelphia, from the region where Dr. Rex, well-known collector of Myxomycetes, gathered most of his material.

3. Bryophytes

In 1913, the Botanic Garden received from Annie Morrill Smith (Mrs. Hugh M. Smith) her entire collection of mosses (10,124) and hepatics (649), together with her invaluable library covering the same groups.[1] This is the largest single gift of herbarium and library material ever received by the Botanic Garden, and has provided an admirable foundation upon which to build along the lines represented by the collections.

4. Algae

The collection includes about 2,000 sheets from the Museum, the Collin-Holden-Setchel Phytotheca Boreali-Americana, C. F. Durant's Algae and Corallines of the Bay and Harbor of New York (1850), Mr. D. I. Banks' Long Island Algae, and others. Also, *Index Algarum Universalis,* of Josephine E. Tilden.

In the development of scientific work at the Garden, emphasis has been placed on the experimental aspects of botany, and there has been no effort to make the Brooklyn Botanic Garden primarily a taxonomic center.

The herbaria are being developed rather as a supplement to

[1]This collection also included 1,019 specimens of Lichens.

the living collections and to investigations in progress, with a view to including plants from all parts of the world of some special interest, whether horticultural, economic, or scientific. From the last point of view it is sought to have representatives of all the families of the higher plants, and particularly of those genera in the various families which appear to suggest the primitive condition of the family.

LIBRARY

The Botanic Garden library comprises at present over 11,000 volumes and more than 8,300 pamphlets. During 1926, there were received current numbers of 847 periodical and serial publications and government documents, devoted exclusively, or in part, to botany and various aspects of plant life and gardening. These include practically all of the more important botanical journals published. The card catalogue contains more than 35,500 Torrey Botanical Club index cards and over 19,500 *Index Algarum Universalis* cards. Among special collections may be mentioned the following:

1. The Library of Annie Morrill Smith (Mrs. Hugh M. Smith), from 1902 to 1905 co-editor, and from 1906 to 1911 editor of the *Bryologist*. This collection comprises chiefly works on mosses, hepatics, and lichens, and includes many rare and important items.

2. A growing collection (127 volumes as of January 1, 1927) of pre-Linnaean works, including a number of botanical incunabula. These foundational works, including numerous rare items, and most of the important herbals, are being built up with the income from the Benjamin Stuart Gager Memorial Fund, presented to the Garden in 1918 by two anonymous donors. The principal of this fund was originally $10,000, and has since been increased, by reinvestment, to $13,417.20. The annual income is used to purchase rare or expensive works that the library might not otherwise be able to afford.

3. The pamphlet collection has been built up by purchase and exchange and by correspondence with investigators and institutions throughout the botanical world, and is rich in authors'

separata and publications issued originally as pamphlets. Each pamphlet is bound and readily accessible on the open shelves.

In addition to a portion of the Botanic Garden Collections Fund (contributions to which are solicited annually), and a portion of the income from other sources, the entire income from the following permanent funds is devoted to library purposes in the amounts indicated:

1. George C. Brackett Library Fund ($500)	$ 27.48
2. Benjamin Stuart Gager Memorial Fund ($13,417.20)	737.92
3. Martha Woodward Stutzer Memorial Fund ($10,000)	275.00
Total	$1,040.40

The income from other sources brings the library budget for 1927, for the purchase of publications and for binding, to a total of about $4,400.

The library is administered strictly as a reference library, and is open free to the public daily (except Sundays and Holidays) from 9 a.m. until 5 p.m., Saturdays from 9 a.m. until noon. By special arrangement investigators may have access to the library outside of official days and hours.

PLANT HOUSES

The plant houses comprise the following:

a. Conservatories, of 9 houses, containing a collection of tender and tropical plants.

b. Instructional Greenhouses, 3 in number, for adult and children's classes.

c. Propagating House.

d. Experimental Greenhouses, 4 in number; two each are assigned to the departments of plant pathology and of genetics.

EXPERIMENTAL GARDEN

The experimental garden, adjacent to the plant houses, comprises about one acre of land, and is utilized at present in connection with investigations in genetics, plant pathology, forest pathology, and the Beardless Iris project.

UNIVERSITY AFFILIATION AND COOPERATION

By terms of an Agreement, entered into in 1917, between New York University and the Brooklyn Botanic Garden, courses of graduate rank offered by the Botanic Garden, when approved by the Faculty of the Graduate School of New York University, are listed as courses in the Graduate School, and are given the same credit as other graduate courses. Properly qualified students who take these courses may present them in satisfaction of the requirements for advanced degrees given by the University.

By special arrangement credit has also been granted by Columbia University for investigations carried on at the Botanic Garden in partial fulfillment of the University requirements for the master's and doctor's degrees.

PUBLICATIONS

The Brooklyn Botanic Garden has been interested not merely in the development of research within its own walls, but in its encouragement in a larger way throughout the botanical world. In harmony with this broad policy, it has made possible the establishment of two new and much needed journals, has afforded favorable conditions for the continuation of a third, and is cooperating in the business management of a fourth.

American Journal of Botany.—The offer of the Garden to assume certain financial obligations and a local habitation for the *American Journal of Botany* (in cooperation with the Botanical Society of America) was one of the large factors that made possible the establishment of that journal in 1914. Previous to that time research papers were being produced at a rate so much faster than they could be published by all existing periodicals that fully a year must elapse between the acceptance of a manuscript and its publication. The establishment of the *American Journal of Botany* under the aegis of the Brooklyn Botanic Garden offered temporary relief. So greatly has botanical research increased in amount since the establishment of that journal that the situation with reference to tardy publication is almost as bad now as in 1914.

Ecology.—A similar service was rendered by the Garden in

1920 by cooperating with the Ecological Society of America in the establishment of the quarterly journal, *Ecology*.

Genetics.—In 1922 the Garden became the publisher of the bi-monthly journal, *Genetics*, in cooperation with the Editorial Board of that journal.

These three periodicals all have a circulation throughout the scientific world, in all countries, the circulation of the *American Journal of Botany* being, so far as we can ascertain, the largest of any technical botanical journal.

The publication of these serials, together with the Brooklyn Botanic Garden *Contributions* and the *Memoirs* of the Brooklyn Botanic Garden, has made the Garden one of the active centers of botanical publication. The location of this work at the Garden has also strengthened our other work and greatly extended our usefulness.

On January 15, 1927, the Garden entered into an agreement with the AMERICAN FERN SOCIETY for cooperation in the business management of the *American Fern Journal*, the quarterly, official publication of that Society. This was in connection with the project of genetical studies of the Boston Fern (*Nephrolepis*), which have been carried on at the Garden since 1915 by Dr. Ralph C. Benedict, Editor of the Journal and Resident Investigator at the Garden since April 1916. (See p. 161.)

RESEARCH COURSES

The following research courses, open to those properly qualified for independent investigation, are announced in the educational *Prospectus* for 1926–7. For each of these courses, there is a charge covering all expenses, including laboratory fee, of *$30 for each full course* of 100 credit hours, and *$20 for each half course* of 50 credit hours.

E6. Research in Mycology and Plant Pathology.—Independent investigation of problems relating to fungi and fungous diseases of plants. Dr. Reed.

E7. Research in Plant Genetics.—Independent investigation of problems of variation and heredity, including the phase of

cytology having a direct bearing on the subject matter of genetics.
Dr. White.

E8. Research in Forest Pathology.—Independent investigation of the diseases of woody plants. Dr. Graves.

E9. Research in Systematic Botany of the Flowering Plants.
Dr. Gundersen.

SCHOLARSHIPS AND FELLOWSHIPS

There is, strictly speaking, no provision for scholarships nor fellowships at the Garden, although at present two Research Assistantships afford advantages similar to fellowships.

The endowment of several Fellowships with permanent funds sufficient to yield incomes of $1,800–$2,500 each is greatly needed. Here is an attractive opportunity for the promotion of scientific research.

FINANCIAL

The activities of members of the Botanic Garden Staff fall under one or more of three heads—Administration, Education, Research. In some positions the duties are fairly evenly distributed, in others they may come chiefly under one or another of these three heads, as the case may be. It is not always easy to draw the line, as, for example, between educational and administrative work. In endeavoring to analyze the total Botanic Garden Budget for 1927, an attempt has been made to distribute the various salaries among the above three headings, on the basis of the approximate relative time the employee gives to these various activities.

Salaries of persons whose work is wholly, or in large part, devoted to maintenance of buildings and grounds and to business administration are classed under "Administration and Maintenance." It is, however, a fair question whether the salaries of gardeners (for example) should come under maintenance or under education or partly under each, for the plantations are maintained primarily for educational purposes. In the following an-

alysis, however, these salaries are classed under "Administration and Maintenance." The figures are on the basis of the budget for 1927.

The Library, which serves all phases of the Botanic Garden's activities, is here treated as a major subdivision of the Garden, and its budget is accordingly reported as a separate item.

TABLE I. DISTRIBUTION OF THE BOTANIC GARDEN BUDGET FOR 1927

Items	For Research	For Education	For the Library	Administration and Maintenance
1. Personal Service	$27,070.00	$36,916.00	$ 5,780.00	$52,443.00
2. Tax Budget, Other than Pers. Serv.		500.00		15,195.00
3. Research Fund (Special Contribution)	9,500.00			
4. Other Private Funds				
a. Publishing Research	540.00			
b. Publishing Research	590.00			
c. Miscellaneous		21,702.00	4,444.00	500.00
Totals	$37,700.00	$59,118.00	$10,224.00	$68,138.00

From these figures it appears that, of a total budget of approximately $175,000, the expenditures are distributed as follows:

1. Administration and Maintenance	39%
2. Library	6
3. Education	33
4. Research	22
	100%

NEEDS OF THE BROOKLYN BOTANIC GARDEN FOR RESEARCH

The time has passed when it is necessary to demonstrate the value of scientific research, whether from the theoretical or practical point of view. Those who have only superficial information on the subject know, for example, that the annual profits from

"radio" (which is only applied physics) represent a truly fabulous interest on the total amount invested in electrical research since the discovery of electricity. The same is true of the annual saving in crop-production resulting from the practical application of the results of research in plant breeding and in plant physiology and pathology. Examples from botanical science could be multiplied.

It is, perhaps, not an extreme statement to say that no investment of funds ever yielded larger material returns than investment in scientific research. To these material results there must be added the intellectual and cultural benefits of such work, the value of which to mankind can hardly be overestimated. The results of botanical research compare favorably with those in any other department of knowledge.

The research program of the Brooklyn Botanic Garden has, from the beginning, laid emphasis on those aspects of botany which have an applied as well as a cultural value—plant breeding, plant pathology, the relation of plants to their surroundings, plant physiology. In the current budget nearly 40 per cent. is for administration and only a little more than 20 per cent. for research. This relationship should be reversed. To increase our research program to twice its present extent would not require any additional buildings or grounds, but only a larger income to provide for salaries, equipment, publication, and miscellaneous incidentals.

The present income of the special Research Fund for Plant Pathology is $7,500, underwritten by friends of the Garden for a period of three years, terminating with the end of 1928. This annual income is equivalent to the interest at 5½ per cent. (the present average yield on all Botanic Garden permanent funds) on approximately $140,000. To provide for this work on a scale more nearly commensurate with its importance and needs, and to extend and enrich our entire program of research to the extent of making the fullest use of our present housing and administrative facilities would require not less than the income at 5½ per cent. on $500,000, or $27,500.

It is hoped that an endowment of not less than this amount may be secured before the close of 1928. The Director of the Garden will be glad to confer with anyone who may be interested

in these plans, and to supply further detailed information as to the activities contemplated and their importance.

ON THE PRESENT INADEQUATE PROVISION FOR BOTANICAL RESEARCH IN THE UNITED STATES

It has been seriously urged in certain quarters during recent years that botanical research is already sufficiently provided for by the various agricultural colleges, agricultural experiment stations, the scientific bureaus of the United States Department of Agriculture, and the departments of botany (and the various subdivisions of that science) in our universities. In order to secure a consensus of opinion on this question, letters were recently sent from the Brooklyn Botanic Garden to representative investigators, scientific administrators, and laymen, whose opinions should have weight in such matters, asking whether, in their judgment, the present provisions for botanical research are adequate to the need, considering the extent of the field and the economic as well as scientific and educational importance of a knowledge of plant life. A number of the letters received are reproduced in the following pages. As will be seen, the writers are unanimous in their opinion that botanical research is still quite inadequately provided for.

DEPARTMENT OF COMMERCE
OFFICE OF THE SECRETARY
WASHINGTON

My dear Dr. Gager:

I have received your letter of March 23d.

I do not hesitate to express my opinion that the work which the Brooklyn Botanic Garden is now doing and projecting in the line of research in plant pathology is of high usefulness from the standpoint of both pure and applied science, and that while such excellent work is already being done in this field by various governmental, university, and experimental station agencies, this work is still far from adequate to meet the existing need. The enormous importance to our national strength of an adequate scientific knowledge of the diseases and pathology in general of plants, especially our cultivated plants, is unquestionable; and I

sincerely hope that the Brooklyn Botanic Garden may find substantial financial assistance in its attempt to help meet this need.

Faithfully yours,

(Signed) HERBERT HOOVER

DEPARTMENT OF AGRICULTURE
WASHINGTON

Dear Sir:

Your letter of December 16, asking for a statement regarding the possible duplication of work on the part of this Department and the Brooklyn Botanic Garden, has been received.

It is my conviction that investigations in plant breeding and plant pathology, to which you especially refer, at the present time are not carried on on an adequate scale to keep abreast of the many new and important problems that are becoming apparent. The biological sciences are as yet in their infancy and even taking all of the universities, state experiment stations, botanic gardens, and other special scientific institutions in connection with the Federal departments there is very little if any actual duplication of effort in the investigation of these problems; and it is unlikely that such duplication will occur for many years to come.

I would like to add that I am especially interested in the enlargement and improvement of botanic gardens for I believe that these institutions offer opportunities for a thorough investigation of many important long-time problems which are difficult, if not impossible, for any other institution to satisfactorily provide.

Very truly yours,

(Signed) W. M. JARDINE,
Secretary

NATIONAL RESEARCH COUNCIL
WASHINGTON, D. C.

Dear Doctor Gager:

I am glad to learn that the Brooklyn Botanic Garden is endeavoring to increase its endowment in order that it may extend its research activities. There is crying need for fundamental research along the lines of plant breeding and plant diseases, lines of much scientific importance and of great practical utility. De-

spite the attention paid to research in these subjects in Government agricultural bureaus, state experimental stations, and special research institutes, much more should be done.

The increase in the last quarter century of our general knowledge of heredity presents a basis for rapid advance along the lines of many specific biological problems involving matters of inheritance. The tremendous practical importance of an intensive knowledge of plant breeding and plant protection to this country of rapidly increasing population, with a consequent growing importance of the food problem, is obvious to any thoughtful person. Too much scientific work cannot be done along this line; nor too much money made available for this work.

Very sincerely yours,

(Signed) VERNON KELLOGG,
Permanent Secretary

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

ITHACA, NEW YORK

Dear Dr. Gager:

The fear that work in science may be duplicated, when a new agency enters the field, is an unconscious expression of the feeling that there exists in nature a definite sum of knowledge to be uncovered and that when one fact is subtracted there remains that much less to investigate. But there is no such limit. The uncovering of one fact or phenomenon only discloses another. There are no remainders. The field is limitless. If ten times the present researches in plant breeding, diseases, and other lines were now to be instituted, we should still be touching only the borders of the unknown. Plant breeding is not one subject, but a congeries of a thousand and one problems. No two persons are likely to attack the same identical problem or in the same way. This may be said of any other field to which we happen to have given a name. We need many minds under different environments trained on all the problems of science. There need be no fear of duplication in research in any field. We shall never have enough of it.

I hope you will be able to assemble your endowment and to

continue and extend your present work, in which you have made such good beginnings.

Yours with best wishes,

L. H. BAILEY, *President*

SMITHSONIAN INSTITUTION
WASHINGTON, D. C.

Dear Doctor Gager:

Through your recent letter I am pleased to learn of your plans for continuance of your research work along the lines of plant breeding and plant diseases. Such investigations are highly commendable as they cannot fail to result in information of the highest scientific value, much of which will be applied in a practical way by great agricultural interests of this country. The field to be covered in such investigations is broad, and there is little danger of conflict of interest with other organizations interested in similar researches. In fact, it is my opinion that where such research work is properly coordinated, it is far better to have several organizations attacking the problem, as this will inevitably lead to greater advance in knowledge.

Your work has proved so highly important in the past that I trust you will meet with success in your efforts to continue it along similar lines in the future.

Sincerely yours,

(Signed) CHARLES D. WALCOTT,
Secretary

NATIONAL RESEARCH COUNCIL
WASHINGTON, D. C.

Dear Dr. Gager:

I am, of course, very much interested in the plans for securing the more permanent endowment of experimental botanical research in the Brooklyn Botanic Garden. The record of accomplishment in this line by the Brooklyn Garden is already a most creditable one and it would be little short of disastrous to have the work interrupted.

I have always felt that such institutions as the Brooklyn Botanic Garden are especially well adapted to serve as centers for funda-

mental research on all problems connected with the experimental study of plant growth and crop production. They are free to choose problems from the standpoint of their fundamental significance for future agriculture rather than merely their bearing on local and sometimes temporary needs. We shall always need to supplement the work of the agricultural colleges and experiment stations by providing institutions, which from their organization and traditions are free to devote their energies to the investigation of the more fundamental aspects of our knowledge of plant life. It seems to me also that your choice of plant pathology and genetics as the lines of research in which you are specializing is very well considered. It is generally agreed that the problems of food production for the future are to be worked out along the lines of improved methods of crop protection based on a better understanding of the fundamental nature of plant diseases and the improvement of our crop plants by rational methods of breeding new types with special adaptations, both for disease resistance and productiveness.

Very truly yours,

(Signed) R. A. HARPER,
Professor of Botany, Columbia University,
Formerly Chairman, Division of Biology and Agriculture

165 BROADWAY
NEW YORK

My dear Dr. Gager:

It seems to me there is a definite need for research in botanical science which shall be in the field of pure science, detached wholly from any direct purpose of economic development. The Federal research of which you speak all looks more or less definitely toward rather quick economic results and is necessarily guided by this in a very large measure.

Furthermore, in a field so large it is certain that some of it will be left uncovered and the work of the Brooklyn Botanic Garden can readily be so directed as to supplement rather than duplicate that which is proceeding elsewhere. I am strongly of the opinion that it will never be possible to do too much of this work so long as it is under sincere and well-informed scientific guidance,

for it touches the field of industry at many points in addition to its purely agricultural side.

I am writing, as you will note, from the general rather than the particular point of view, but I think there can be no doubt of the facts from whatever point of view they are regarded.

Yours sincerely,

(Signed) WILLIAM C. REDFIELD
(Secretary of Commerce in President Wilson's Cabinet)

HARVARD UNIVERSITY
BUSSEY INSTITUTION FOR RESEARCH IN APPLIED BIOLOGY

My dear Doctor Gager:

I am very glad that there seems to be some prospect for an enlarged program at the Brooklyn Botanic Garden because of increased endowment. I am very enthusiastic about the matter because such research as is going on at the Garden is so important, yet because of its fundamental nature it is difficult to prove this adequately to those who are not trained biologists.

Yours sincerely,

(Signed) E. M. EAST,
Professor of Experimental Plant Morphology

BOYCE THOMPSON INSTITUTE FOR
PLANT RESEARCH, INC.
YONKERS, N. Y.

Dear Dr. Gager:

I have your letter of December 16 asking my opinion on whether it was desirable for private institutions to expand their research along the line of genetics and plant diseases, or whether all of this research can be adequately cared for by state and government institutions.

The state and government institutions are very busy in taking care of immediate, pressing problems. This gives them little time for working out the fundamental problems. Our advance depends very largely on working out fundamentals. This can be best done by private endowed institutions because they do not need to answer legislatures or Congress as to the immediate application of the work they are doing.

I feel that in the botanical field our biggest present need is for a greater amount of fundamental research. I hope very much that your Garden, as well as many other private botanical institutions in America, may expand in this direction.

Very sincerely yours,

(Signed) WILLIAM CROCKER,
Director

FORM OF GIFT OR BEQUEST

TO

BROOKLYN BOTANIC GARDEN

I hereby give (devise or bequeath) to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of.....Dollars, the income from which said sum is to be used for the educational and scientific work of the Brooklyn Botanic Garden.

The Brooklyn Institute of Arts and Sciences

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THE PRESIDENT OF THE BOROUGH OF BROOKLYN
THE COMMISSIONER OF PARKS, BOROUGH OF BROOKLYN

GENERAL INFORMATION

Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 1000 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park Station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS

OF THE

BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, seed list, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I. *Dedication Papers:* comprising 33 scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. 521 pages. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. By Norman Taylor, June 11, 1923. 108 pages. Price $1.00, plus postage.

Volume III. Vegetation of Mount Desert Island, Maine, and its environment. By Barrington Moore and Norman Taylor. 151 pages. *In press.*

CONTRIBUTIONS. Established, April 1, 1911. Papers originally published in periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

42. Variation among the sporelings of a fertile sport of the Boston fern. 27 pages, 15 figures. 1924.

43. Inheritance studies in Pisum. V. The inheritance of scimitar pod. 14 pages, 10 figures. 1925.

44. Modes of infection of sorghums by loose kernel smut. 17 pages, 3 plates. 1925.

45. The inheritance of resistance of oat hybrids to loose smut. 19 pages. 1925.

46. Geographical distribution and the cold-resisting character of certain herbaceous perennial and woody plant groups. 10 pages. 1926.

47. The cause of the persistent development of basal shoots from blighted chestnut trees. 7 pages, 1 figure. 1926.

48. Further evidence of physiologic races of oat smuts. 8 pages. 1927.

49. Chromosome and gene mutations in Datura following exposure to radium rays. 5 pages. 1927.

50. The climate of Long Island; Its relation to forests, crops, and man. 20 pages, 2 plates. 1927.

51. Experimental studies on head smut of corn and sorghum. 16 pages, 5 plates. 1927.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Established, December, 1914. Since 1925 issued each year in the January number of the RECORD.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published, in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $7.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly. Subscription, $6.00 a year.

BROOKLYN BOTANIC GARDEN RECORD

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PROSPECTUS

OF COURSES, LECTURES, AND OTHER EDUCATIONAL ADVANTAGES OFFERED TO MEMBERS AND TO THE GENERAL PUBLIC

1927-8

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BROOKLYN BOTANIC GARDEN

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* The names are arranged alphabetically.
† Resigned, October 1, 1927.
** Resigned, July 6, 1927.
*** Resigned, September 1, 1927.

INFORMATION ABOUT THE BROOKLYN BOTANIC GARDEN

THE BROOKLYN BOTANIC GARDEN, established in 1910, is a Department of the Brooklyn Institute of Arts and Sciences. It is supported in part by municipal appropriations, and in part by private funds, including income from endowment, membership dues, and special contributions. Its articulation with the City is through the Department of Parks.

By an agreement with the City of New York, the functions of the Garden have been defined as two-fold, and may be summarized as follows: first, the advancement of botanical science through original research; and, second, the dissemination of a knowledge of plants.

The first of these activities is carried on by curators, resident investigators, fellows, and others, who devote all or a part of their time to independent investigation.

The second, the dissemination of botanical knowledge, is accomplished in the following ways:

I. By the teaching of classes—
   a. of children who come voluntarily outside of school hours;
   b. of children who come with their teachers from public and private schools for special lessons on plant life and closely related subjects;
   c. of adults who are interested in some phase of pure or applied botany.

II. By lectures at schools and elsewhere by the various staff members.

III. By loan sets of lantern slides accompanied by lecture text, for use in the schools.

IV. By the distribution to schools of study material for classes in botany, biology, and nature study.

V. By public lectures and educational motion pictures at the Botanic Garden.

VI. By maintaining labelled collections of living plants, arranged systematically and otherwise on the grounds and in the Conservatories of the Garden.

VII. By the herbarium, containing specimens of preserved plants from all parts of the world.

VIII. By maintaining a reference library on plant life and related subjects, open free to the public daily (except Sundays and holidays).

IX. By the following periodicals, published by the Botanic Garden:

1. American Journal of Botany.
2. Ecology.
3. Genetics.
4. Brooklyn Botanic Garden Record.
5. Leaflets.
6. Contributions.
7. Memoirs.

X. By the maintenance of a Bureau of Public Information on all phases of plant life.

XI. By providing docents to accompany members and others who wish to view the collections under guidance.

XII. By cooperating with City Departments and other agencies in the dissemination of botanical knowledge.

The Brooklyn Botanic Garden is also taking an active part in the State-wide movement for legislation for the conservation of our native American plants.

CONTENTS

	Page
I. Cooperation with Local Schools	1
II. Docentry	4
III. Courses of Instruction	4
A. Children's Gardens: Nature Study	4
1. Courses for Children	5
2. Courses for Teachers	7
B. Courses for Teachers of Children's Gardening and Nature Study	8
C. Courses for the General Public	11
1. Full Year Course	11
2. Fall Courses	11
3. Spring Courses	12
D. Course for Student Nurses	13
E. Consultation and Independent Investigation	13
IV. Other Educational Features	15
Plantations, Conservatories, Herbarium, Library, Laboratory Building, Instructional Greenhouses, Children's Room, Children's Garden Building, Children's Gardens, Rose Garden.	

PROSPECTUS: 1927-28[1]

I. COOPERATION WITH LOCAL SCHOOLS

The Brooklyn Botanic Garden aims to cooperate in every practicable way with the public and private schools of Greater New York in all matters relating to the study of plants and closely related subjects. The purpose of the Garden in this connection is to supplement and enrich the school work in the way of instruction, demonstration, study material, etc., which otherwise would not be available.

Geography classes, as well as classes in nature study and botany, are finding the collection of useful plants in the economic plant house, and also our Japanese Garden, valuable adjuncts to their class work. Arrangements may be made by teachers of geography to have their classes study these collections under the guidance of a docent. Illustrated lectures for geography classes may also be arranged for at the Garden.

The systematic collection in the main part of the Garden, where the living plants are arranged by orders and families, is proving of great value for demonstration to visiting high school classes in botany.

A. Talks at Schools.—The principals of public or private schools may arrange to have lantern talks given at the schools on various topics related to nature study, such as garden work with children, tree planting, and Arbor Day. If an illustrated lecture is desired, the lantern and operator must be provided by the school, but slides will be furnished by the Botanic Garden. Address the *Curator of Elementary Instruction* for a list of talks and for appointments.

B. School Classes at the Garden.—(*a*) Schools not provided

[1] Brooklyn Botanic Garden Record, Vol. XVI, No. 4, October, 1927.

with a stereopticon, and other schools, may arrange for classes, accompanied by their teachers, to come to the Botanic Garden for lectures either by the teacher or by a member of the Garden Staff.

(*b*) Notice of such a visit should be sent at least *one week* previous to the date on which a talk is desired. Blank forms are provided by the Garden for this purpose. These talks will be illustrated by lantern slides, and by the conservatory collection of useful plants from the tropics and subtropics. Spring and fall announcements of topics will be issued during 1927–8.

(*c*) The Garden equipment, including greenhouses, plant material, lecture rooms, lantern and slides, is at the disposal of teachers who desire to instruct their own classes at the Garden. Arrangements must be made in advance so that such work will not conflict with other classes and lectures. For High School classes address the *Curator of Public Instruction.* For Junior High and Elementary School classes address the *Curator of Elementary Instruction.*

(*d*) The principal of any elementary or high school in Brooklyn may arrange also for a series of six lessons on plant culture to be given during the fall or spring to a class. These lessons will be worked out for the most part in the greenhouse. Such a course must be arranged for in advance, and the class must be accompanied by its teacher. This is adapted for pupils above the third grade.

C. Seeds for School and Home Planting.—Penny packets of seeds are put up by the Botanic Garden for children's use. In the early spring, lists of these seeds and other information may be secured on application to the *Curator of Elementary Instruction.*

D. Conferences.—Conferences may be arranged by teachers and principals for the discussion of problems in connection with gardening and nature study. Appointments must be made in advance. Address Miss Ellen Eddy Shaw.

E. Study and Loan Material.—To the extent of its facilities, the Garden will provide, on request, various algae and protozoa, as well as living plants, leaves and twigs, or other plant parts for study. Where containers are necessary, as in the case of the algae and protozoa, they must be furnished by the school. Petri dishes will, on request, be filled with sterilized nutrient agar ready for use in the study of bacteria and molds. They should be

delivered to the Garden, *clean,* and in general one week before the agar is desired. In all cases arrangements must be made by the teachers for calling for such material.

MATERIAL USUALLY AVAILABLE

1. Protozoa: Paramoecium, Vorticella, and others.
2. Pleurococcus.
3. Spirogyra.
4. Vaucheria.
5. Blue-green algae.
6. Moss plants: gametophyte and sporophyte, with capsules.
7. Fern prothallia. For these, a Petri dish with a cover is the best container to bring, since the prothallia dry out quickly.
8. Fern sporophylls (with sori).
9. Coleus and Tradescantia—variegated green and white, loaned for photosynthesis experiment.
10. Cacti, Pitcher plant, Sundew (*Drosera*), and Venus's Flytrap (*Dionaea*)—loaned for demonstration.
11. Elodea—to show movement of protoplasm.
12. Various collections loaned for exhibit: *e.g.,* lichens, fungi, plant diseases, fruits, modified leaves, demonstrations of Mendel's law.

Teachers may also arrange to have various physiological experiments or demonstrations conducted at the Garden for the benefit of their classes. Communications in regard to these matters should be addressed to the *Curator of Public Instruction.*

F. Loan Sets of Lantern Slides.—Sets of lantern slides have been prepared for loan to the schools. Each set is accompanied by a short syllabus of explanatory nature. In all cases these sets must be called for by a special messenger and returned promptly in good condition. The subjects now available are as follows. Other sets are in preparation.

1. Plant Life
2. Spring Wild Flowers
3. Common Trees
4. Fall Wild Flowers
5. Forestry (2 sets)

II. DOCENTRY

To assist members and others in studying the collections the services of a docent may be obtained. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted. This service is free of charge to members; to others there is a charge of 50 cents per person. For information concerning membership in the Botanic Garden see page 3 of the cover of this PROSPECTUS.

III. COURSES OF INSTRUCTION

A. Children's Gardens: Nature Study

For the work in Children's Gardening and Nature Study the following equipment is available:

1. *The Children's Gardens,* on a piece of land about three-quarters of an acre in extent, in the south-east part of the Botanic Garden, divided into about 150 plots which are used throughout the season for practical individual instruction in gardening.

2. *The Children's Building,* at the north end of this plot, containing rooms for consultation and for the storage of tools, seeds, notebooks, special collections, etc.

3. *The Instructional Greenhouses,* three in number, for the use of juvenile as well as adult classes for instruction in plant propagation and related subjects.

4. Two *Classrooms* (in addition to the Boys' and Girls' Club Room in the Laboratory Building), equipped with stereoscopes and views, a stereopticon, plant collections, economic exhibits, models, and other apparatus and materials for instruction.

5. Two *Laboratory Rooms,* with the usual equipment for plant study.

6. The *Auditorium,* on the ground floor, capable of seating 570 persons, and equipped with a motion-picture lantern and stereopticon.

In addition to these accommodations, the dried plant specimens in the herbarium and the living plants in the conservatories and plantations are readily accessible, while the main library and chil-

dren's library, which contain a comprehensive collection of books on every phase of gardening and plant life, may be consulted freely at any time.

1. *Courses for Children*

The following courses are open to all boys and girls. Enrollment in these courses entitles the boy or girl to membership in the Boys' and Girls' Club of the Brooklyn Botanic Garden. This club, having an active membership of about 1,000, meets four times a year for discussion of subjects related to plant life. Papers, by members, on various botanical and horticultural subjects, are read at these meetings, and the speakers are then entitled to a silver pin, providing they have satisfactorily completed courses of study at the Garden extending over at least six months. For announcement concerning Children's Room see page 17.

A1. Fall Greenhouse Work.—The following courses are self-explanatory and are for both beginners and advanced students:

Class A.—Open to boys and girls who have never taken any greenhouse work before. Bulbs used: narcissus, oxalis, primrose; also geranium cuttings. *Saturday* mornings at 9:15. *Fee, fifteen cents. October 22 to December 17.*

Miss Hammond and Miss Clark.

Class B.—Open to boys and girls over thirteen years of age. Subjects studied: hyacinth, Easter lily, calla lily, the botany of common cultivated plants, etc. *Fee, twenty-five cents. Saturday* mornings at 9:15, *October 22 to December 17.* Miss Woodward.

Class C.—Open to boys and girls who have been in at least two fall bulb classes before this. This class is for advanced work. The bulbs used will be hyacinth, tulip, narcissus, oxalis. Geranium cuttings and primroses will also be used. Time of class, 10:30, *Saturday* mornings. *Fee, fifteen cents. October 22 to December 17.*

Miss Hammond and Miss Clark.

Class D.—Open to any boy or girl. Subject: the making of garden Christmas presents. There will be a choice of gifts. Some of the articles made will be the following: a flower basket, seed packet, flower book-mark, painted pot and plant to go in it, flower calendar, wooden box with flower design, etc. *Saturday* mornings at 10:30. *Fee, cost of materials. October 22 to December 17.*

Miss Hammond.

Class E.—Silver Pin work as applied to greenhouse and garden work. The members of this class will be selected from students eligible for this work. *Fee, twenty-five cents.* Miss Hammond.

A2. Junior Gardeners' Course.—This is a course for boys 14–17 years of age. Lessons are given in the care of border and other flower beds, in the weeding and care of small vegetable gardens, in mowing and watering lawns, repotting plants, etc. This is planned to fit boys for summer work and to enable them to obtain positions. Hours to be arranged. *Fee, fifty cents.*

Miss Shaw.

A3. Preparation for the Outdoor Garden.—The following classes are open to boys and girls during the spring of each year. The courses are planned for a better understanding of plant life and so that the outdoor garden may become a more intelligent piece of work. On account of limited space in the Children's Greenhouse, classes are limited to twenty. The fee for each course is *fifteen cents* to cover the cost of material.

Boys' Spring Course.—(a) *Saturday* mornings, 9–10:15, *February 11 to April 14.* (b) *Saturday* mornings, 10:30–11:30, *February 11 to April 14.* Miss Hammond and Miss Clark.

Girls' Spring Course.—(a) *Saturday* mornings, 9–10:15, *February 11 to April 14.* (b) *Saturday* mornings, 10:30–11:30, *February 11 to April 14.* Miss Woodward.

A4. Advanced Work for Older Boys and Girls.—How to raise plants, mix soils, transplant, start seedlings for outdoor gardens, etc. Boys and girls who have taken spring courses under A5 are eligible for advanced work. The fee for the course is *twenty-five cents.* Each student may take home his plants and seedlings. This course is open to both boys and girls over twelve years of age. *Saturday* mornings at 9:30, *January 7 to February 11.* Miss Hammond.

A5. The Beginners' Garden.—Open annually to 50 boys and girls who have never had instruction in gardening at the Brooklyn Botanic Garden. This course takes up the subject of the small garden, what to plant, how to plant it, care, replanting, etc. *Application for plots should be made in person or in writing before March 1.* Size of plots 8 ft. by 10 ft. All crops belong to the individual. *Fee, twenty-five cents. Saturday* mornings, 9–12, *April 28 to October 13.* Miss Hammond and Miss Clark.

A6. Second Year Gardens.—Open to 50 boys and girls who have had one or more seasons at the Brooklyn Botanic Garden—a continuation of Course A5. Registration should be made before September 1 of each year for the following year. *Fee, twenty-five cents. Saturday* mornings, 9–12, *April 28 to October 13.*
Miss Sargent.

A7. Junior Garden Assistants.—Open to older boys and girls, or to those who have mastered Courses A2 and A4. Size of plot 10 ft. by 20 ft. These gardens are for the raising of vegetables. The work is in the nature of a project, "How much can one raise on a plot 10 ft. by 20 ft.?" Hours to be arranged. The student must put in at least two periods a week during the summer vacation, and, if possible, three. Registration date: *April 7. Fee, fifty cents.* Miss Hammond.

A8. Advanced Nature Work.—A course designed for those older boys and girls who have taken Courses A1–A5. Herbarium specimens will be prepared and the simpler principles of plant classification studied. Projects will be assigned to individuals. *Open only to pupil assistants of the Garden.* Hours to be arranged. *No fee.* Miss Shaw.

A9. Nature Study for Boy Scouts, Girl Scouts, Camp Fire Girls, Scout Leaders, and Others.—Short courses of at least four periods each, with talks, demonstrations, and field trips in the grounds of the Botanic Garden and Prospect Park to study trees, shrubs, etc. The instruction and schedule dates will be adapted to meet the needs of the various groups that apply. *Open only to groups of at least ten persons.* Hours to be arranged. *No fee.*
Dr. Graves, Miss Hammond, and assistants.

A10. Special Work for High School Pupils.—A course in gardening or greenhouse work adapted for high school pupils. Classes to be arranged for by the high school teacher. *No fee.*
Miss Shaw, Miss Hammond.

2. *Courses for Teachers*

The following brief courses are designed primarily for teachers who wish to extend their knowledge of nature study and gardening for use in their school work, without taking the longer courses described under B, page 8. It should be noted that only the

latter courses are accepted by the Board of Education for teachers' credits.

A21. Greenhouse Work for Teachers.—Not given in 1928.

A22. The School Garden.—See B5, p. 10.

A23. Spring Nature Study for the Classroom.—Not given in 1928.

A24. Fall Garden Work.—Three lessons on home plants; window boxes; indoor planting of bulbs; the outdoor bulb bed. *No fee. Mondays, 4 p.m., October 3–17.* Miss Shaw.

A25. Fall Nature Study.—This course is a complement to the spring nature study work, and the material used will be the common material one would use in classroom work, showing seed dispersal, evergreens, deciduous trees, etc. Such subjects as Nature's preparation for winter will be considered. Three lessons. *No fee. Mondays, 4 p.m., October 17–31.* Miss Hammond.

A26. Greenhouse Work.—A course planned for those who have taken "B3, Principles of Agriculture and Horticulture." Fifteen weeks of practical work in the greenhouse. *Limited to 20 members. Fee, eight dollars. Tuesdays, 4 p.m., beginning October 4.* Miss Shaw.

A27. Greenhouse Work.—Starting of seedlings for the outdoor garden. Fifteen weeks. *Limited to 20 members. Fee, eight dollars. Mondays, 4 p.m., February 6–May 14.*
Miss Shaw.

B. Courses for Teachers of Children's Gardening and Nature Study

The courses for teachers in children's gardening are planned not only to prepare for garden work, but for the teaching of nature study as well. The courses are so arranged that they emphasize not only the theory of each subject, but its actual practice, either in classroom, greenhouse, garden, or field. At the same time the work is correlated to meet the needs of each grade of the elementary school. There is an increasing demand for good nature study work in our schools, and we make a special point of giving simple, definite, helpful work, grading it so that it applies directly to the immediate needs of our own city schools. Practice with classes of children of different ages is given in all this work.

The requirements for entrance are a certificate from a city training or a normal school, a college diploma, or several years of certified successful teaching. These courses may be completed during one year, or may be extended over a period of two or more years. The *fee for the entire course is thirty-five dollars,* payable in full at the time of registration, or course by course in advance. No money will be refunded if the student drops the work, and no monetary allowances will be made for courses taken at other institutions, although time allowances will be made.

Special stress is put upon the outdoor garden practice. This practice is of two kinds: (1) Practice with children. There are one hundred and fifty children in our outdoor garden, and every opportunity is given for practice in working with children and for the solving of problems connected with this phase of the work. (2) Practice in the teacher's garden. Each member of the class has a garden of her own and works it herself, thus performing all gardening operations to be taught later to children.

To those who satisfactorily complete this course a certificate will be given. *The five courses offered in children's gardening constitute one unit.* Open only to teachers.

These courses have been accepted by the Board of Education of the City of New York for teachers' credits as follows:

1. Any of the courses will be accepted toward meeting clause "b" of the conditions of eligibility for a high-school license in biology.

2. The course in Pedagogy of Botany and Educational Principles of Children's Gardening (**B4**) will be accepted as a satisfactory 15-hour course in Pedagogy toward meeting the requirement of 60 hours' work in Pedagogy in lieu of the written test in Principles and Methods of Teaching for Promotion License.

3. This course will be accepted as a pedagogical course, and any of the other four courses will be accepted as an academic course toward meeting the conditions of exemption from the academic paper in the examination for license as assistant to principal. Such exemption is granted to those who offer 120 hours of satisfactory work, 60 of which must be in the Science of Education and 60 in some branch of literature, science, or art, such 120 hours' work not being accomplished wholly within one academic year.

These courses have also been accepted by the Brooklyn Teachers' Association and appear in its syllabus of courses.

The individual student may apply at any college for credits on these courses, which will be granted according to individual merit.

B1. General Botany.—Thirty sessions. A course designed to make clear the fundamental principles of morphological and physiological botany. Although, with a view to correlation with the other courses described below, particular emphasis is laid upon the higher plants, all of the main groups of plants are considered, by means of informal lectures, discussions, demonstrations, and visits to the living material in the conservatories and the outdoor plantations. *Fee, $5. Thursdays,* 4 p.m., beginning *October 6.*
Dr. Graves.

B2. Nature Study.—Thirty sessions. This course covers the plant material used in teaching nature study, and includes the identification of the common trees, shrubs, plants, wild flowers, and weeds. Mounts, charts, and diagrams are made. The student becomes familiar with the actual material. The course is entirely practical, work being done in both field and laboratory. Two hours of class work are credited as one hour. *Fee, $5. Tuesdays,* 4 p.m., beginning *September 20.* Miss Hammond.

B3. Principles of Agriculture and Horticulture.—Thirty sessions. This course will be especially helpful to teachers. The principles of horticulture are considered and applied in a practical way through greenhouse, laboratory, and lecture work. The greenhouse work includes the following subjects: plant propagation by means of bulbs, rhizomes, roots, seeds, etc.; the care of the greenhouse; house plants; window-box materials; fertilizers. Insect and fungous pests, grafting and pruning are also included from both a practical and a theoretical point of view. *Fee, $7. Wednesdays,* 4 p.m., beginning *September 28.*
Miss Shaw and Mr. Free.

B4. Pedagogy of Botany and Educational Principles of Children's Gardening and Nature Study.—Not given in 1927–28.

B5. Garden Practice.—Fifteen sessions. This course is entirely practical and includes all the outdoor work of the student in his own garden, applying the principles of agriculture and gardening, work with children in the garden, basketry and woodwork.

Fee, $5: for summer practice, fee $8 additional. Thursdays, 4 p.m., *February 2 to May 17.* Miss Shaw and Miss Hammond.

C. Courses for the General Public

The following courses are open to any one who has a general interest in plants. Teachers are welcome. They are *free to members of the Botanic Garden;** for others a small fee is required, as specified. Registration should be made with the instructor in person or by mail at least one week before the course opens, in order that adequate material, etc., may be provided. *No course will be given when less than six apply.*

1. *Full Year Course*

C10. The Life of Plants.—Thirty exercises, extending through the school year, consisting of informal lectures, demonstrations, and short trips to the conservatories and outdoor plantations. No previous knowledge of botany is necessary. The main purpose of the course is to enable any who are interested to become acquainted with the different main groups of plants—their life histories, habits, economic uses, etc. Bacteria, algae, fungi, lichens, mosses, ferns, cycads, and flowering plants are considered. The various functions manifested by plant life in general, such as growth, reproduction, sensitiveness, movement, respiration, and metabolism, are also discussed. *Fee, $5. Thursdays,* 4 p.m., beginning *October 6.* Dr. Graves.

2. *Fall Courses*

C4. Gardening in the Fall.—Six lessons, with practical work in the greenhouse, on the methods of making cuttings, the various kinds of bulbs for fall planting, their treatment and care, the proper management of house plants, and a discussion of the kinds suitable for cultivation. *On account of restricted space in the greenhouse, this class must be limited to 40. Registration according to the order of application. Fee, $3.00. Thursdays,* 4 p.m., *September 29 to November 3.* Mr. Free.

* For information concerning membership in the Brooklyn Botanic Garden consult the third page of the cover of this PROSPECTUS.

C5. Trees and Shrubs in their Winter Condition.—Eight outdoor lessons in the Botanic Garden and elsewhere in Greater New York on the characteristics of our common trees and shrubs, both native and cultivated, emphasizing their distinguishing features in the winter condition. *Fee, $4.00. Saturdays,* 2:30 p.m., *October 1 to November 19.* Dr. Graves.

C13. Fall Flowers, Fruits, and Seeds.—Four outdoor lessons in the Botanic Garden. The common native and cultivated plants which flower in the fall, and the fruits and seeds commonly seen at this time of the year are pointed out and their characteristics studied. In case of rain, exercises are postponed one week. *Fee, $2. Mondays,* 4–5:15 p.m., *October 10–31.* Dr. Gundersen.

3. *Spring Courses*

C1. Plants in the Home.—How to grow them. Six talks with demonstrations. Practice in potting, mixing soils, making cuttings, etc. This course deals with the principles to be followed in raising plants. The members of the class have the privilege of keeping the plants they have raised. *Fee, $3.00. Thursdays,* 4 p.m., *February 16 to March 22.* Mr. Free.

C3. The Flower Garden.—Making the most of it. Five lessons. How to improve soils and get results from planting; old-fashioned flowers; annuals; summer bedding; vines for screening unsightly objects; rose culture; growing of ornamental shrubs; pruning; how to make a lawn and maintain it. (Not offered in 1928.)

C7. The Story of the Flowering Plants.—Three illustrated lectures on the evolution of the group of the flowering plants, discussing the interrelationships of the various families, and comparing the forms of the more general and specialized lines of development. *Fee, $1. Fridays,* 4 p.m., *March 2–16.*
Dr. Gundersen.

C8. Plant Families.—Eight outdoor lessons in the botanic garden, taking up the structure of flowers and the characteristics of the more important plant families. *Class limited to 25. Fee, $4.00. Fridays,* 4–5:15 p.m., *April 27 to June 15.*
Dr. Gundersen.

C9. Trees and Shrubs of Greater New York.—Ten outdoor lessons at the Garden and elsewhere in Greater New York, the principal object being to gain a ready acquaintance with the common trees and shrubs of the eastern United States, which are well represented in this region. The species are considered in systematic order, and the features pointed out by which they may be most easily recognized; also their habits, rate of growth, economic value and use, methods of planting and propagation; importance in forestry, horticulture, and landscape art. *Limited to 50 members enrolled in the order of application. Fee, $5.00. Saturdays, 2*: 30 p.m., *April 7 to June 9.* Dr. Graves.

C11. Spring Flowers and Ferns of the New York Region.—This is a field course of eight exercises given in the parks and woodlands of Greater New York. The common native and naturalized wild flowers are visited as they come into flower, and their characteristics and distinguishing features studied. *Class limited to 30, taken in the order of application. Fee, $4.00. Saturday afternoons; April 28 to June 16.* Dr. Gundersen.

C12. The History of Botany.—(Not offered in 1928.)

D. Course for Student Nurses

D1. General Botany with Special Reference to Medicinal Plants.—A course of conferences, demonstrations, and field trips for student nurses. The general principles governing the life of plants, as well as the use and care of flowers in the sick room will be considered. Special attention will be paid to the identification of officinal plants in the field. Hours to be arranged. *No fee.* Dr. Graves.

E. Consultation and Independent Investigation

1. *Consultation*

Consultation and advice, and the facilities of the laboratories, library, and herbarium are freely at the service of members of the Botanic Garden and others with special problems relating to plants or plant products, especially in the following subjects:

1. **Plant diseases** (phytopathology) and classification of fungi (mycology). Dr. Reed.

2. **Plant breeding** and allied subjects (genetics and experimental evolution).

3. **Plant geography** (phytogeography) **and ecology.**
Mr. Taylor.

4. **Classification and identification of flowering plants** (systematic botany). Dr. Gundersen.

5. **The growing of cultivated plants** and their arrangement; also their adaptation to soils, climate, and other factors (horticulture and gardening). Mr. Free.

2. *Investigation* *

For the following research courses, open to those properly qualified for independent investigation, there is a charge covering all expenses, including laboratory fee, of *$30 for each full course* of 100 credit hours, and *$20 for each half course* of 50 credit hours.

E6. Research in Mycology and Plant Pathology.—Independent investigation of problems relating to fungi and fungous diseases of plants. Dr. Reed.

E7. Research in Plant Genetics.—Independent investigation of problems of variation and heredity, including that phase of cytology having a direct bearing on the subject matter of genetics. (Not offered in 1928.)

E8. Research in Forest Pathology.—Independent investigation of the diseases of woody plants. Dr. Graves.

E9. Research in Systematic Botany of the Flowering Plants.
Dr. Gundersen.

* Courses of graduate rank offered by the Botanic Garden, when approved by the Faculty of the Graduate School of New York University, are listed as courses in the Graduate School, and are given the same credit as other graduate courses. Properly qualified students who take these courses may present them in satisfaction of the requirements for advanced degrees given by the University. Graduate credit has also been allowed elsewhere for such advanced work done at the Garden.

IV. OTHER EDUCATIONAL FEATURES

Plantations

The plantations comprise several sections, as follows:

1. General Systematic Section (trees, shrubs, and herbaceous plants arranged according to orders and families).
2. The Local Flora (native wild flower garden).
3. Ecological Garden.
4. Rock Garden.
5. Children's Garden.
6. Japanese Garden, etc.
7. Rose Garden.

As noted under *Docentry,* arrangements may be made for viewing the plantations under guidance. They are open free to the public daily from 8 a.m. until dark; on Sundays and holidays from 10 a.m. until dark.

Conservatories

The Garden conservatories contain a collection of tender and tropical plants. Of special interest for teachers of nature study and geography are the following useful plants from the tropics and subtropics: banana, orange, lemon, lime, kumquat, tamarind, West Indian cedar (the source of the wood used for cigar boxes), eucalyptus, Manila hemp, sisal, pandanus (source of the fiber used for making certain kinds of fiber hats), fig, grape vines from north and south Africa, date palm, coconut palm, chocolate tree, coffee, tea, ginger, bamboo, mahogany, balsa, cocaine plant, black pepper, cardamom, olive, pomegranate, logwood, durian, mango, sugar cane, avocado (so-called "alligator pear"), West Indian and other rubber plants, banyan, religious fig of India, and numerous others.

The Conservatories are open April 1 to October 31, 10 a.m.–4:30 p.m. (Sundays, 2–4:30); November 1 to March 31, 10 a.m.–4 p.m. (Sundays, 2–4).

Herbarium

The Garden herbarium consists at present of over 186,500 specimens, including phanerogams, ferns, mosses, liverworts, lichens,

parasitic and other fungi, algae, and myxomycetes. This collection may be consulted from 9 a.m. until 5 p.m. by those interested, and specimens submitted will be gladly identified.

Library

The rapidly growing library of the Garden comprises at present over 11,000 volumes and over 8,300 pamphlets. This is not a circulating library, but is open free for consultation to all persons daily (except Sundays and holidays) from 9 a.m. until 5 p.m. (Saturdays, 9 to 12). Over 800 periodicals and serial publications devoted to botany and closely related subjects are regularly received. These include the transactions of scientific societies from all quarters of the globe, the bulletins, monographs, reports and other publications of various departments of the United States Government, as well as those of foreign governments; of all state agricultural experiment stations and agricultural colleges; the publications of research laboratories, universities, botanic gardens and other scientific institutions of the world, as well as the files of independent journals devoted to the various phases of plant life. The library is especially rich in publications of foreign countries.

Laboratory Building

The Laboratory Building contains (besides offices of administration and the Library and Herbarium mentioned above) four laboratory rooms, a culture room, two classrooms with stereopticon and other equipment for instruction, a room for the installation of temporary exhibits, six private research rooms, and an auditorium seating about 570 and equipped with motion picture machine, stereopticon and lecture table supplied with water, gas, and electric current for lectures involving experimental work.

Instructional Greenhouses

A range of three greenhouses, each about 20 x 30 feet, is provided for the practical instruction of children and adults in plant propagation and other subjects.

Children's Room

A gift of $1,500 in 1921 from the late Mrs. George D. Pratt, supplemented in 1923 by a further gift of $500 from Mr. George D. Pratt, has made it possible to provide a beautifully decorated room for the use of the Boys' and Girls' Club. Any boy or girl who is enrolled, or has been enrolled, in any of the children's classes at the Garden is eligible for membership in this club, which now numbers about 1,000 active members. The room contains shelves for a nature-study library, of which a nucleus has already been secured, and is equipped with stereoscopic views, photographs, and preserved and living specimens of plant life, for the instruction and entertainment of boys and girls. The room is open free to all children. Contributions of specimens and of books on nature study and closely related subjects will be most welcome.

Children's Garden Building

This is located in the northern part of the Children's Garden plot and contains a conference room, and rooms for the storage of garden tools and implements. The children's conference room was refitted last year with furniture appropriate to its uses. The furniture was a gift from Mrs. James H. Post. Various collections of plants, seeds, and insects of economic importance in the Garden are accessible here for consultation by the children. North of the Children's Building is a plot planted to ornamental shrubs and herbaceous perennials for the instruction of the children.

Children's Gardens

A plot of about three quarters of an acre in the southeast part of the Botanic Garden has been set aside for the theoretical and practical instruction of children in gardening. The larger part of this area is laid out in garden plots which will accommodate about 150 children. In 1925 there was added to the southern part of this plot a Shakespeare Garden, the gift of Mr. Henry S. Folger.

Rose Garden

In June, 1927, a gift of $10,000 from Mr. and Mrs. Walter V. Cranford, of Greenwich, Connecticut, made possible the immediate realization of the project for a Rose Garden, proposed in the last Annual Report. As this Prospectus goes to press, work on the new garden, which will occupy about an acre of land near the north end of the Botanic Garden and just west of the esplanade, is well under way. The plan provides not only for the display of the so-called bedding or garden roses that will grow out-of-doors, and for demonstration of the varied possibilities of climbing roses, post roses and standards, but also for as complete collections as can be obtained of wild or natural species, showing their foliage and massing qualities. Old-fashioned and historical roses will also be featured. It is probable that many of the plants will be set out this fall.

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GENERAL INFORMATION

Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 1000 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park Station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS
OF THE
BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, seed list, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I. *Dedication Papers:* comprising 33 scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. 521 pages. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. By Norman Taylor, June 11, 1923. 108 pages. Price $1.00, plus postage.

Volume III. Vegetation of Mount Desert Island, Maine, and its environment. By Barrington Moore and Norman Taylor, June 10, 1927. 151 pages. Price $1.60.

CONTRIBUTIONS. Established, April 1, 1911. Papers originally published in periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

42. Variation among the sporelings of a fertile sport of the Boston fern. 27 pages, 15 figures. 1924.

43. Inheritance studies in Pisum. V. The inheritance of scimitar pod. 14 pages, 10 figures. 1925.

44. Modes of infection of sorghums by loose kernel smut. 17 pages, 3 plates. 1925.

45. The inheritance of resistance of oat hybrids to loose smut. 19 pages. 1925.

46. Geographical distribution and the cold-resisting character of certain herbaceous perennial and woody plant groups. 10 pages. 1926.

47. The cause of the persistent development of basal shoots from blighted chestnut trees. 7 pages, 1 figure. 1926.

48. Further evidence of physiologic races of oat smuts. 8 pages. 1927.

49. Chromosome and gene mutations in Datura following exposure to radium rays. 5 pages. 1927.

50. The climate of Long Island; its relation to forests, crops, and man. 20 pages, 2 plates. 1927.

51. Experimental studies on head smut of corn and sorghum. 16 pages, 5 plates. 1927.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Established, December, 1914. Since 1925 issued each year in the January number of the RECORD.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published, in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $7.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly. Subscription, $6.00 a year.